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THE GEOGRAPHICAL ORIGIN AND DISTRIBUTION
OF NORTH AMERICAN BIRDS, CONSIDERED
IN RELATION TO FAUNAL AREAS
OF NORTH AMERICA.¹

BY J. A. ALLEN.

THE PRESENT paper consists essentially of two parts. The first treats of the probable geographical origin and present distribution of the genera of birds represented in North America, regardless of any inferences that may be drawn from this general presentation of the facts of the case; the second relates to the subdivision of the continent into faunal areas of various grades, with reference to their relationships, classification and nomenclature. No very novel views, nor many new facts are presented, the paper being in great measure a restatement of generally known facts in a new sequence, with a view to giving them greater emphasis in their bearing upon the special subject in hand. The leading ideas here embodied have already been set forth by the writer in other connections,² but the evidence is here for the first time presented

¹ Read before the Tenth Congress of the American Ornithologists' Union, held in Washington, D. C., Nov. 15-17, 1892.

² See the author's recent paper, 'The Geographical Distribution of North American Mammals' (Bull. Am. Mus. Nat. Hist., Vol. IV, 1892, pp. 199-243, pll. v-viii), and the earlier papers there cited.

in detail from the standpoint of birds. As an introduction to Part I a few pages are devoted to questions having a more or less direct bearing upon the general subject.

I.—THE GEOGRAPHICAL ORIGIN AND DISTRIBUTION OF NORTH AMERICAN BIRDS.

It has long been recognized by nearly all writers on geographical biology that the two leading factors governing the distribution and dispersal of life over the globe are the land connections which now exist, or have formerly existed, between the principal land masses, and climate; and that by far the most potent of the climatic influences is temperature. In considering the faunal relations of North America to the Old World, it is important, therefore, to keep in mind the present slight separation of northern North America from Eurasia, and that, as currently believed by many geologists, the shallow basin now forming Bering Sea was at one time dry land, and thus formed a broad land connection between northwestern North America and northeastern Asia, during at least a portion of the Tertiary.

As is well known, a large proportion of the genera, and many of the species, of both animals and plants occurring in North America have a circumboreal distribution, even in many cases where their present habitats do not extend quite to the Arctic regions. Furthermore, that many genera, particularly of birds, which are at present limited to the warm temperate and tropical latitudes, are common to both the Old World and the two American continents. It is, in certain cases, hard to see how their present dispersion could have been brought about under the geographic and climatic conditions now existing. Geology here comes to our assistance, furnishing evidence that in earlier times the climate of the globe was not only more uniform, but also much warmer over the regions now buried half the year under snow and ice. It is well known that in Miocene times a warm temperate flora prevailed over the present Arctic regions, and that subtropical plants flourished in Central Europe and in corresponding latitudes in North America. Also that many types of mammals, now represented only in the tropics, formerly ranged over the greater part of the northern hemisphere, as shown by their fossil remains, long

since buried in the Tertiary deposits of both North America and Eurasia. Furthermore, there is abundant evidence of a considerable interchange of life between the two northern continents at a time when there was no climatic barrier, as now, to the northward extension of subtropic types; and that Eurasia was in part populated by types originating in North America; and also that North America has derived a portion of its life from the Old World. There is no reason to suppose that birds were then any less restricted in their means of dispersion than now, in comparison, for example, with mammals, insects, land mollusks and plants.

The past history of birds, while so defective in comparison with that of some other groups, affords proof of the former much wider dispersion of certain types than obtains at the present time. While for this class the geological record is so imperfect, it suffices to show that what are now strictly tropical genera, for example, formerly reached southern and central Europe. It also affords evidence that birds in Tertiary times were not so very different from the birds of to-day. The leading genera of the raptorial, gallinaceous, wading and swimming birds were much the same as now¹; with them existed other genera which have since become extinct, while many of the now prevalent forms were absent, and have doubtless come later into existence. The

¹ Among the existing genera of birds found in the Tertiary of Europe and North America are the following, most of which date back to the Miocene, and some to the Eocene.

Struthio	Olor	Columba
Colymbus	Phœnicopterus	Buteo
Podiceps	Leptoptilus	Aquila
Podilymbus	Ibis	Falco
Uria	Ardea	Milvus
Larus	Grus	Strix
Sterna	Rallus	Bubo
Puffinus	Fulica	Psittacus
Phaëthon	Phalaropus	Picus
Sula	Scolopax	Leptosoma
Phalacrocorax	Tringa	Trogon
Pelecanus	Totanus	Calloccalia
Merganser	Numenius	Corvus
Anas	Charadrius	Scolecophagus
Spatula	Coturnix	Passer
Anser	Phasianus	Sitta
Branta	Meleagris	Motacilla

fragile nature of most bird skeletons, and the small size of the greater part of the species, and the fact that only those of more or less aquatic habits would be liable to rapid entombment under conditions favorable for their preservation, are circumstances which render hopeless any expectation of the future discovery of the ancestral lines of the great bulk of our present avian fauna.

Two hypotheses, however, may be hazarded regarding the present limited distribution of many groups now restricted within comparatively small areas. First, that they had not only a local origin, but that for some not very obvious reason they have always had a local distribution, as for example the Todies in the West Indies, and various South American and tropical Old World types. Second, that they have become specialized since the close of the Tertiary, with adaptations to a tropical or semi-tropical environment.

There is evidence that towards the close of the Tertiary a marked change in the earth's climate took place, culminating in the Glacial Period, during which the whole northern half of the northern hemisphere became covered with a heavy ice cap, lasting for possibly thousands of centuries, and extending its chilling influence nearly to the northern tropic. The rise of the glacial period was of course gradual, and the southward progress of the great ice cap drove before it all forms of life capable of any considerable power of locomotion, while those unable thus to escape must have perished from cold. There was hence a great crowding together of exiles from the north into the more favored regions to the southward, leading to an intense struggle for existence, and a weeding out on a grand scale of forms least fitted for the contest. This period must thus have been one of great activity in the evolution of new types. Opportunity was given for the gradual adaptation of many forms to a lower temperature than that to which they had been accustomed, and to an enforced change of food. The recession of the ice fields was accompanied by the gradual extension northward of habitable land. A broader area becoming available in summer than in winter an annual migration for a greater or less distance on the part of the pioneer life became a necessity. Finally the ice receded to its present limits and the whole north, under radically altered climatic conditions, became again available for occupation by the more or less modified descendants of the pre-glacial exiles. To some of

these a comparatively low temperature had doubtless become congenial, and from them may have been derived the distinctively arctic and subarctic birds of the present age. They belong mainly to our present circumboreal genera, and are unrestricted by climatic conditions in their dispersal throughout the arctic and subarctic regions.

Other forms proved less flexible, and remained in latitudes more nearly corresponding to the climatic conditions of pre-glacial times. They had, however, before the beginning of the Glacial Period, become broadly dispersed, and now are found in widely disconnected areas. We have thus a reasonable explanation of the disconnected distribution of congeneric species in such groups as the Tree Ducks, Egrets and Herons, Spoonbills, Flamingoes, Snakebirds, Gannets, Gallinules, Barn and Pigmy Owls, Kites (genus *Elanus*), Trogons, Barbets, Kingfishers, Swifts, Goatsuckers, Piculets, and a few Passerine birds. On the other hand, doubtless many of the peculiar tropical types of land birds were already restricted to somewhat near their present limits, and that they have never had a much wider dispersion than they have at the present day. Many of them are also possibly of comparatively modern origin. It is only on this supposition that we can account for the numerous peculiar types that at present characterize the subtropical and tropical areas of the several continents.

It is not probable, for example, that such exclusively tropical American families as the Formicariidæ, the Dendrocolaptidæ, the Galbulidæ, the Todidæ, the Toucans, the Motmots, the Cotingas, etc., have ever had a much wider range than now. It seems also probable that such distinctively American types as the Hummingbirds, the Icteridæ, the Tyrant Flycatchers, the Tanagers, the Vireos and the Mniotiltidæ, which for the most part have their centers of abundance in the tropics, with merely outlying members in temperate North America, have never had a wider range than at present, and that most of their outlying genera and species have, under the intense struggle for existence in the overcrowded tropics, become gradually somewhat modified to adapt them to slightly more boreal conditions, thus in course of time more or less extending the general habitat of the families to which they respectively belong. At the far north they are still cut off from further extension by an insuperable

climatic barrier, and have thus been unable to reach any part of the Eurasiatic continent.

The Glacial Period and the change of climate it produced has not only had a profound and permanent influence upon the distribution of life in the northern hemisphere, but proved a powerful agent in the evolution of new types, and in the extinction of old ones; it also left its impress upon the majority of northern birds through the development in them of the habit of migration: for it is now generally conceded that this habit must have originated in consequence of the great reduction of temperature beginning about the close of the Tertiary. Prior to this period, owing to the comparatively uniform climatic conditions then obtaining almost everywhere, there could have been no necessity for extended periodic movements. Later a nearly uniform temperature throughout the year gave place in northern latitudes to warm summers followed by winters of great severity. During the waning of the ice period the area offering a congenial summer home to a great multitude of birds became greatly extended, from which, however, they were driven by semi-arctic winters to seek favorable winter haunts further southward.

We have here what seems a natural and reasonable hypothesis for the origin of migration, and one now currently accepted by ornithologists. In this way, it is believed, the habit of migration not only originated but has become established as an irresistible hereditary impulse, as inherent and mandatory as the 'instinct' of reproduction.

In this connection, a few words may not be out of place respecting the question, Why do birds migrate? In considering this question, it should be borne in mind that there is everywhere, and has ever been, a constant and intense struggle for existence—that throughout nature the birth rate is far above the possibilities of permanent increase. Hence, in the bird world, as elsewhere, every station affording favorable conditions for existence must be occupied; there can be no unutilized areas. Many birds are organized to subsist only upon insects or soft fruits, or upon both combined; such food abounds in summer far to the northward of where it can be obtained in winter. Thus some of our Swifts, Swallows and Flycatchers range in summer almost to the borders of the Arctic Circle, where for a few weeks in summer they find abundance of food and a congenial temperature. Here they

bring forth their young, but are forced to retire at the approach of autumn, retreating gradually before the southward advance of colder weather, passing through the middle latitudes in September, and reaching the tropics in October or November, the time varying more or less with different species. Here they remain till the increased warmth of March or April, or the stimulus of the approaching breeding season admonishes them of the necessity of revisiting their breeding stations, when they begin to retrace the journey toward their summer haunts, keeping pace so exactly with the advance of the season as not to lose even a day of the brief interval available for their sojourn in their far northern home. They are thus wanderers—exiles, as it were,—for three fourths of the year. Evidently our northern-breeding insectivorous and berry-eating birds could not survive a winter at their breeding grounds. They might perhaps be able to pass the whole year in the tropics, or in the lower temperate latitudes,—at the risk, however, of over-crowding the regular occupants, and also of leaving a habitable area unoccupied. As a matter of fact, nature not only ‘abhors a vacuum,’ using the phrase in a strict sense, but allows no waste places; living space is always at a premium. Near relatives of our subarctic and cold temperate insectivorous birds are found in the tropics and throughout the temperate latitudes; while the tropical forms are non-migratory, those breeding in the temperate latitudes are less so than their more northern kin; they remain, owing to the longer summer, for a greater length of time at their breeding stations and have a shorter journey to reach their winter haunts.

This may serve as a general illustration, showing that the absence of proper food in the high north forces the summer insectivorous birds to leave these regions for warmer latitudes, where can be found the food their peculiar organization renders necessary. In short, as our knowledge of the habits and migrations of birds increases, it becomes more and more evident that the cause of the autumnal migration is failure of proper food at the breeding station.

Why migratory birds ever leave their winter haunts seems at first sight less obvious, since in most instances it can hardly be due to failure of the food supply, nor to any absolute incompatibility of climate. The return in spring is often attributed to strong home love, evidence of the existence of which is shown by the

return of birds to the same locality—even to the same nesting site—for many successive years. There is so much indubitable proof of this, that it is commonly assumed as the rule in most species. It is certainly beyond question that birds do not select their breeding stations in any hap-hazard way, journeying north along a vague course and stopping to nest wherever the proper conditions of season and other surroundings happen to prove favorable. Hence the impulse that governs their spring movements has been loosely termed the 'home instinct.'

If we consider that migration consists really of two movements—that is from the breeding station to the winter quarters and then back again—and that the one movement is the necessary complement of the other, it is hardly necessary to seek for a separate cause for the two movements; the two together constitute migration in a complete sense, which, as already explained, is an inherited habit,—an inherent, irresistible impulse, closely blended with the function of reproduction. The promptings which lead to the migratory movement, respectively in fall and spring, have unquestionably a different origin; the autumnal movement being doubtless prompted by a reduction of temperature and a failing food supply, while the spring movement is incited by the periodic activity of the reproductive organs, resulting in the necessity for the return of the species to the peculiar conditions and surroundings to which for long ages it has been undergoing special adaptation—in other words, to its home.

In the present paper, North America is considered in its faunal rather than its geographical sense, and in the synopsis here following the area covered by the A. O. U. Check-List and its Supplements is the region mainly considered, namely, North America north of Mexico, but including the peninsula of Lower California. The number of species now recognized in the A. O. U. Check-List as occurring within this area is about 795, with nearly 270 additional subspecies, making a total of about 1065 species and subspecies. These are arranged under 303 genera, with about 65 additional subgenera. Of these, however, 75 species and 25 genera occur merely as accidental stragglers from the Old World, the West Indies and Mexico. Deducting these as not valid components of the North American fauna, leaves about 720 species and 278 genera as legitimately North American, under the present restriction of the term. In the following

synopsis, subgenera will be in the main ignored, as their consideration is found to rarely modify the results derived from a consideration of the genera. Unless otherwise stated, the breeding range alone is taken into account.

The Pygopodes, as recognized in the A. O. U. Check-List, consist of three families, Podicipidæ, Urinatoridæ, and Alcidiæ. The Podicipidæ constitute a small, well circumscribed group, of almost universal distribution, and of great antiquity, dating at least from the Miocene, with a closely related ancestral form in the Eocene. The number of genera recognized varies from two to half a dozen or more, according to the views of different systematists. Most of these so-called genera, however, are little more than subgenera, and as such are geographically limited to particular regions, some being tropical or austral, while others are confined to the temperate portions of the northern hemisphere, where they have a circumpolar distribution, as *Colymbus* and *Dytes* of the North American fauna. *Æchmophorus*, scarcely more than a well-defined subgenus, is confined to western temperate North America, though allied to a connective form between *Æchmophorus* and *Colymbus* in South America. It is thus a distinctively American type. *Podilymbus*, consisting of a single species common to a large part of both North and South America, is quite sharply separated from the other members of the family, as a type peculiarly American, fossil remains of which, according to Dr. Shufeldt, occur in the Pliocene deposits of Oregon.

The Loons, forming the family Urinatoridæ, are distinctively northern, and to a large degree arctic or subarctic, though some of the species range in the breeding season throughout the cold temperate latitudes. It is a compact, sharply defined group, consisting of a single genus and less than half a dozen species; nearly all of them are circumboreal, none being distinctively American. The Loons form one of the early types, having survived with apparently little change from the close of the Eocene.

The Alcidiæ, more numerous in genera and species than either the Grebes or Loons, are, like the Loons, a strictly northern type, several of the genera being among the most arctic of birds. With a superficial resemblance to the Penguins of the antarctic seas, but no close kinship, they may be regarded as their arctic repre-

sentatives in the rôle they fill in nature's economy. The Auks number 13 genera and about 24 species, displaying considerable diversity in size and form, and especially in the size and structure of the bill, and in the character of the nuptial ornaments. Considering their high northern range, one is struck with the greatly circumscribed distribution of many of the genera, only five out of the 13 being circumpolar, three being confined to the shores of the North Atlantic and Eastern Arctic Oceans, and five to the shores of the North Pacific and Bering Sea. Their limited distribution and diversity of structure indicate a plastic group of comparatively modern development. Being maritime species, none of even the non-circumpolar species can be claimed as distinctively either North American or Eurasiatic. In favor of their recent origin is the fact that, while almost arctic in habitat, few of the genera have acquired a circumpolar distribution, as they would in all probability have done had they existed in the same diversity in preglacial times. The locally restricted forms, moreover, occupy a region where food is exceptionally abundant.

Of the three families of Longipennes, — Stercorariidæ, Laridæ and Rynchopidæ, — the first is arctic, the second of world-wide distribution, and the third essentially tropical. Even the genera of the Longipennes are for the most part either circumpolar, cosmopolitan or tropicopolitan. Not a single genus is distinctively North American, and many of the species are either circumpolar or nearly cosmopolitan.

The Tubinares are so largely pelagic, so wide-ranging, and for the most part so little known as regards their breeding stations, that they will be dismissed without further consideration.

Of the six families of Steganopodes four — Phaëthontidæ, Sulidæ, Anhingidæ and Fregatidæ — are essentially tropical; another, Pelecanidæ, is semi-cosmopolitan, being found almost everywhere outside of the arctic and subarctic regions. The remaining family, the Cormorants (Phalacrocoracidæ), is universally distributed, though the species are largely maritime rather than inland, where they frequent only the larger rivers and lakes. Not a single genus of this whole order is distinctively North American. They are all birds of strong flight, and are apparently old types which have long had a wide distribution, the remains of Gannets, Cormorants and Pelicans occurring in deposits of Miocene age in both North America and Europe.

The Anseres are also a cosmopolitan group, containing many genera of very wide distribution. Particular styles of the Anserine type, however, have been developed over particular regions, as in South America, Australia, and in the Old World tropics. Of the 23 North American genera four only are peculiar to this continent, namely, *Lophodytes*, *Charitonetta*, *Camptolaimus*, and *Chen*, closely allied respectively to the circumpolar genera *Merganser*, *Glaucionetta*, *Somateria* and *Anser*, and are thus obviously derived from northern stock. *Histrionicus* is also almost wholly confined to the northern half of North America, while *Arctonetta* and *Philacte* occur only along the arctic coasts of Alaska and Siberia, like several of the genera of the Alcidae. *Dendrocygna* is tropicopolitan, barely reaching the southern border of the area here under consideration. *Anas*, *Dafila*, *Spatula*, and *Erismatura* are nearly cosmopolitan. The remaining 14 genera of Ducks, Geese, and Swans are circumpolar, and most of them pass the breeding season in the cold temperate or subarctic regions. Thus of the Anseres only about one sixth of the genera are distinctively North American, and in every case are only slight modifications of circumpolar types, and hence of boreal origin, of probably comparatively recent date.

The Odontoglossæ, or the Flamingoes, are tropical,—a small, structurally widely isolated group, dating at least from the Miocene. A single species barely reaches our southern border, though in Pliocene and Post-Pliocene times Flamingoes ranged much farther north than now, both in Europe and North America, and were doubtless more numerous in species, the Flamingoes being a waning group.

Of the Herodiones, the Spoonbills, the Ibises, and the Storks are for the most part tropical, and hence do not enter prominently into the North American fauna. *Ajaja* and *Guara* are tropical American; *Plegadis* is subcosmopolitan and slightly more northern; *Tantalus* is also essentially tropical American, but has closely related forms in the Old World tropics. Our Herons all belong to nearly cosmopolitan genera and subgenera, many of the species being closely representative of Old World forms of corresponding latitudes. The North American Herodiones thus present no forms distinctively American.

The Paludicolæ afford us one form, *Aramus*, peculiar to America, but it barely reaches our southern border. Of the

other genera, *Grus* is common to the whole northern hemisphere; *Rallus* and *Porzana* are almost cosmopolitan, as are likewise *Gallinula* and *Fulica*, leaving only *Ionornis* as peculiar. This, however, is tropical American rather than North American, and has closely allied forms in the Old World tropics. The group is thus not only widely dispersed but of known great antiquity, the fossil remains of *Grus*, *Rallus* and *Fulica* having been found in the Eocene and Miocene deposits of Europe and in the Pliocene of North America.

The six families of the Limicolæ also afford very few peculiar North American genera, and these occur where, at first thought, they would be least expected, namely, among the Snipes and Sandpipers. Of the Phalaropes *Steganopus*, a subgenus of *Phalaropus*, is exclusively North American and the most southern in distribution of the three known species of the group, the others being both arctic and circumboreal. It is also of interest to note that, according to Dr. Shufeldt, its remains occur in the Post-Pliocene deposits of southeastern Oregon, rendering it certain that North America was within the pre-glacial range of the group.

The Stilts and Avocets, on the other hand, are of nearly world-wide distribution, being absent from only the cold temperate and arctic portions of the globe. The same is true also of the Oystercatchers. The Surf-bird, genus *Aphriza*, is an isolated type of extended range on the Pacific coast of both North and South America during migration; its breeding haunts have as yet escaped discovery.

The two remaining families are the Scolopaciæ and the Charadriidæ. Of the former fifteen genera are represented in North America. One only, *Gallinago*, may be termed cosmopolitan. Of the other fourteen, six are circumpolar, and *eight* are distinctively North American, the North American genera being *Philohela*, *Macrorhamphus*, *Micropalama*, *Ereunetes*, *Symphemia*, *Bartramia* and *Tryngites*. Three of them breed from the cold temperate southward. Three of them are also restricted to eastern North America, while the other two—*Ereunetes* and *Macrorhamphus*, both monotypic—have each developed an eastern and a western subspecies. *Heteractitis* has a representative in Alaska and another in Eastern Siberia. Of the two genera of Charadriidæ, one, *Charadrius*, is arctic and circumboreal; the other, *Ægialitis*, is cosmopolitan.

We have now passed rapidly in review the Swimmers, Waders, and Shore-birds, with the following results: Total number of genera, 93; of which 74, or 80 per cent., are either cosmopolitan, tropicopolitan, circumpolar, or subcircumpolar, leaving 19, or 20 per cent., as American, of which only 11, or about 12 per cent., are distinctively North American; one half of these belong to the single family Scolopacidae.

The North American Gallinae number 12 genera, of which one, *Ortalis*, is tropical, while *Meleagris* is partly so. The remaining ten genera fall into the two subfamilies, *Perdicinae* and *Tetraoninae*. The four genera of the former are exclusively American; none reach the cold temperate zone, and all range to the southward of the United States; three of them are also exclusively western. Their metropolis is Mexico, where all occur, and where they have their greatest numerical representation. They have no representatives in South America, and no near relatives in any part of the Old World.

The *Tetraoninae* are as emphatically northern as the *Perdicinae* are southern. Of the six North American genera, three are circumboreal, one (*Tympanuchus*) is practically eastern, though formerly, in Post-Pliocene times, according to Dr. Shufeldt, ranging to Oregon; the remaining two, *Pediocates* and *Centrocercus*, are western.

Of the eight genera of Pigeons, one, *Columba*, is subcosmopolitan; two, *Ectopistes* and *Zenaidura*, are North American, though the breeding range of the latter extends to the tropics; the remaining five are tropical American, of which four barely cross our southern border. The Columbine element in our fauna is thus obviously of tropical American origin.

Of the Birds of Prey, the three genera of Vultures are of course tropical American in origin, and still largely so in distribution, reaching only the warmer parts of North America. Of the sixteen genera of the *Falconidae*, nine are either circumboreal or subcosmopolitan, and these all date back, with about the same distribution as now, to the Miocene, while some are known from the Eocene. The remaining seven genera must be ranked as tropical, five of them extending but a short distance into the United States. Hence not a single genus of this large family can be classified as distinctively North American. The same remarks are nearly true of the Owls, four of the twelve genera being cir-

cumboreal and mainly subarctic; six others are subcosmopolitan, while two only are American, namely, *Micropallas* and *Speotyto*, both of which have a rather restricted North American range. The latter doubtless reached North America from two sources, the West Indies, from which the Florida stock came, and Mexico, from which the western stock was derived.

Conurus, the only representative of the great order Psittaci, is of course only a northern outlier of the numerous group of tropical American Conures.

Our Cuckoos are all of tropical American origin, only the single genus *Coccyzus* having an extended North American distribution. *Geococcyx* is doubtless of Mexican origin. Our single genus of Kingfishers is subcosmopolitan.

Of our eight genera of Woodpeckers two, *Picoides* and *Dryobates*, are circumpolar, one being subarctic and the other of wide distribution; three are distinctively North American, while three others range at large over most of the two Americas.

Of the three genera of Swifts one, *Chatura*, is nearly cosmopolitan, one is exclusively North American, and one ranges over a large part of both the American continents.

All of the five genera of Goatsuckers, if *Antrostomus* be recognized as separable from *Caprimulgus*, are exclusively American; one only, *Phalaenoptilus*, is restricted to North America, while *Nyctidromus* does not pass much beyond the Rio Grande.

Seven of the ten genera of Hummingbirds are essentially tropical, barely extending within our limits, while only one ranges over a very large part of the continent. Of the fourteen species, only one is eastern.

The Tyrannidæ, though preëminently a group of the American tropics, is represented by ten genera in North America; five of them, however, are scarcely entitled to rank as North American, and of the remaining five, only two, *Contopus* and *Empidonax*, reach the cold temperate latitudes.

The only American representative of the numerous Old World family Alaudidæ is the genus *Otocoris*, which ranges throughout the greater part of the northern hemisphere.

The Corvidæ are represented by eight genera, three of which are cosmopolitan and one, *Xanthoura*, is tropical. The other four are not only almost exclusively North American, but two of them are limited to the western half of the continent.

The Icteridæ are of course all American. Of the nine genera represented in North America, three (*Dolichonyx*, *Xanthocephalus*, and *Scolecophagus*) are exclusively North American. The six remaining genera range far into the tropics, two of them being mainly tropical; one of them (*Quiscalus*) is also mainly limited in North America to the eastern half of the continent.

The large cosmopolitan family Fringillidæ is represented in North America by thirty genera, twenty-one of which are strictly American and nine circumpolar. Of the twenty-one American, or twenty-three if we give generic rank to *Passerculus*, *Ammodramus* and *Coturniculus*, as I believe should be done, seventeen are exclusively North American; three others are mainly tropical, and three are shared in common by both North and South America. The Fringillidæ, although a cosmopolitan family, give a high ratio of forms peculiarly North American, amounting to fully 60 per cent. Furthermore, three of the North American genera are strictly western, and two strictly eastern, while five of the nine circumboreal genera are either arctic or subarctic.

The tropical American family Tanagridæ is represented by only two genera, namely, *Euphonia* and *Piranga*, only the latter extending over even the warm temperate portion of the continent, while the former barely reaches our border.

Of the six genera of Swallows none is essentially North American. *Tachycineta*, *Progne* and *Stelgidopteryx* range over both Americas; *Chelidon*, *Petrochelidon* and *Clivicola* are old World, each with a single species in North America.

Of the family Ampelidæ, the genus *Ampelis* is common to the colder parts of the northern hemisphere, but is most likely of American origin; the other genus, *Phainopepla*, is western and southern.

Lanius is the single representative of the very numerous and otherwise exclusively Old World family Laniidæ.

The Vireos range over both Americas, to which they are limited, with their metropolis in Middle America.

The Mniotiltidæ constitute the most characteristic family of North American birds, 70 per cent. of the twenty genera occurring in North America. Considering the family as a whole, three genera are exclusively West Indian; *Basileuterus*, which scarcely reaches our border, is continental and tropical; *Comptosia* and *Geothlypis* range throughout the warmer parts of

both continents, being tropical rather than North American, and nearly the same may be said of *Setophaga*. *Granatellus*, *Cardellina* and *Ergaticus* are Mexican and Central American, the two latter barely reaching our Mexican frontier. *Dendroica* is represented by about forty species, of which twenty-four, or about 60 per cent., may be considered as distinctively North American, while eleven, or 80 per cent., of the remaining species are West Indian; two are Central American and one occurs in the Galapagos Islands. Thus, in general terms, about one fourth of the species are West Indian and three fourths North American. The remaining eight genera are strictly North American, while three of them, *Helmitherus*, *Helinaia* and *Protonotaria*, are restricted to the eastern half of the United States, as is also *Compsothlypis*, so far as its United States distribution is concerned. *Mniotilta* is also eastern.

The large and widely dispersed Old World family Motacillidæ has only two genera in North America—*Budytes*, barely reaching Alaska, and the nearly cosmopolitan genus *Anthus*.

Cinclus is a mountain type, common to most of the higher mountain ranges of America and Eurasia.

The Troglodytidæ is almost exclusively an American family, represented in Eurasia by the subgenera *Anorthura* and *Elachura*. A few East-Indian genera are sometimes placed here, as *Sphenocichla*, *Pneopyga*, etc., but I think erroneously. The metropolis of the true Wrens is tropical America, where are found more than nine tenths of all the species of the group. The genera *Cistothorus*, *Thryothorus*, and *Campylorhynchus* extend into the warmer parts of the United States. *Salpinctes* and *Catherpes* are peculiar forms of the West and Southwest, of probably Mexican origin.

The subfamily Miminæ, of late associated with the Wrens, is exclusively American, and four out of the five North American genera doubtless originated near where they are now found. One of them, *Galeoscoptes*, is essentially eastern and one, *Oroscoptes*, is western. *Mimus* is tropical, with a single outlying species in North America.

Of the Paridæ, *Sitta* and *Parus* are found throughout the greater part of the northern hemisphere; *Chamæa*, *Psaltriparus*, and *Auriparus* are mainly limited to the northern border of Mexico and the adjoining tier of States to the northward, a

single species of *Psaltiriparus* extending southward to the higher mountains of Guatemala, and another northward along the Pacific coast to Washington.

Certhia and *Regulus* belong to the northern hemisphere, ranging over its northern half; *Polioptila* is tropical American, with outlying species extending across the warm temperate.

The cosmopolitan family Turdidæ is represented by three genera—*Merula*, *Turdus* and *Saxicola*—of wide dispersion, and by two—*Hesperocichla* and *Sialia*—which may be considered as autochthonous; the sixth genus, *Myiadestes*, is tropical American, with a single species in the western United States.

In concluding our review of the land birds, the results may be summarized as follows: Total number of genera, 181; of these 55, or 30 per cent., are circumboreal or otherwise wide-ranging Old World forms; 126 genera, or 70 per cent., are American, of which 35, or 28 per cent., are essentially tropical, leaving 91 genera, or about 50 per cent., as distinctively North American.

Separating the Land Birds into the two categories of Passerine and non-Passerine, we find that of the 75 non-Passerine genera, 36 per cent. are wide ranging Old World forms, leaving 64 per cent. as American, of which latter 40 per cent. are tropical American, leaving 30 per cent. of the whole as strictly North American. Of the 106 genera of Passeres, only 25 per cent. are circumboreal or otherwise widely distributed in the Old World, leaving 75 per cent. as American, of which four fifths are strictly North American, or 60 per cent. of the Passerine genera.

The total number of genera represented in North America (as geographically restricted in the A. O. U. Check-List) of which account is here taken, is 274; of these 129, or 44 per cent., are either circumboreal or widely dispersed over the Old World, leaving 145, or 56 per cent., as American. Of the latter 102 genera, or about 40 per cent. of the whole, are distinctively North American, and 43 genera, or about 12 per cent. of the whole, may be classed as tropical American.

Of the distinctively North American genera 57 per cent. have a general distribution over the continent, while of the remaining 43 per cent., 17 per cent. are eastern and 26 per cent. are western.

In order to bring still more closely into relief the extent and manner of the relationship of the North American avifauna to

that of the rest of the world, we will divide the non-tropical part of the continent into three belts, namely: (1) An Arctic, including that part of the continent and its adjacent islands north of about the limit of forest vegetation. (2) The Cold Temperate, limited on the north by the Arctic, and on the south by what is commonly recognized as the Canadian Fauna (see Pl. III). Its southern border thus coincides in a general way with the northern limit of the successful cultivation of the staple grains and fruits of the temperate zone. (3) The Warm Temperate, extending from the southern border of the Cold Temperate to about the edge of the palm belt, or to the hot lowlands of Mexico.

The Arctic belt is inhabited during the breeding season by about 65 genera of birds, of which only 5 are exclusively American; the remaining 60 have either a general circumpolar distribution or occur in Eastern Siberia or on the Arctic coast of Europe as well as in North America. None of the 5 American genera is strictly Arctic; they merely extend into the Arctic from the Cold Temperate, while quite a proportion of the circumpolar genera is strictly Arctic in their breeding range.

In the Cold Temperate belt 120 genera are represented, of which 98 are circumpolar and 22 American. Of these 46, or nearly half of the circumpolar genera, range also into the Warm Temperate belt, as do also 14 of the strictly American genera.

In the Warm Temperate belt 95 genera occur which do not range into the Cold Temperate, of which only 12 are Old World, 83 being exclusively American. In addition 60 genera are common to both the Cold Temperate and Warm Temperate, of which 46 are Old World and 14 American. This gives a total of 155 genera in the Warm Temperate, of which 58 are Old World and 97 exclusively American. Besides these, 50 essentially tropical genera reach or extend somewhat into the Warm Temperate, of which 43 are American and 7 tropicopolitan, increasing the total number of genera occurring in the Warm Temperate to about 205.

These statistics illustrate a number of important points: (1) the rapid increase of bird life in North America from the Arctic regions southward, notwithstanding the fact that the continent steadily and greatly decreases in breadth from the north southward, the number of genera in the Arctic belt being 65, in the

Cold Temperate 120, and in the Warm Temperate 205. (2) The decrease of Old World forms from the north southward, in the Arctic belt 91 per cent. of the genera being circumpolar, 82 per cent. in the Cold Temperate, and 37 to 23 per cent. in the Warm Temperate, according to whether the northern or the southern edge of the belt be considered. (3) As the distinctively American genera increase in passing southward, they became more or less differentiated into eastern and western types. Taking land birds alone, to the exclusion of pelagic and strictly maritime, the number of peculiarly eastern genera increases from two or three in the Cold Temperate to 17 in the Warm Temperate, and in the western from three or four in the Cold Temperate to 26 in the Warm Temperate, exclusive in each case of intrusive, essentially tropical forms which if taken into account would still further differentiate the two regions. Besides, as is well known, many genera which range across the continent are represented by different species on the two sides, while most of the continental species are differentiated into eastern and western subspecies, and frequently into a considerable number of local races.

We may now inquire, Whence was derived the present avifauna of North America? It is evident from the facts already presented that it is made up of four prominent elements. The first consists of types common to a large part of the northern hemisphere, which more and more prevail as we proceed from the south northward, till in subarctic and arctic America we meet with little else. The second consists of a rather strong infusion at the southward of types of almost universal distribution over the warmer temperate and intertropical latitudes. Third, a very prominent tropical American element, developed to the maximum just along our southern border and fading out gradually to the northward, little being left of it after we enter the Cold Temperate. Fourth, a very conspicuous autochthonous element, reaching its maximum in the Warm Temperate, and continuing prominent far into the Cold Temperate. This is made up partly of strongly modified Old World types, but mainly of peculiar genera, or at least peculiar species, derived obviously from tropical American stock, which entered our borders partly by way of the West Indies, but mainly by way of Central America and Mexico.

A large part of the distinctively American element in the North American avifauna seems almost obviously of tropical American origin; for example our Vultures, several genera of our Hawks and Owls, our Cuckoos, most of our Woodpeckers, our Nighthawks, Whippoorwills, Swifts, and all of our Hummingbirds; all of our Flycatchers, Orioles and Blackbirds, and our Vireos and Tanagers; many of our Sparrows and Grosbeaks; all of our Gnatcatchers, and the Mockingbirds, some of our Wrens, and a few of our more southern genera of Warblers, as the Yellowthroats and Redstarts.

It seems probable that another portion originated in Mexico, mainly on the great Mexican Plateau, as the Quails, the Turkeys, and some of our Pigeons; a number of our Woodpeckers; the greater part of our Jays, the Pipilos, the various species of *Peucaea*, *Amphispiza* and *Passerina*; the Titmice of the genera *Psaltiriparus*, *Auriparus*, and *Chamaea*; our Wrens of the genera *Catherpes* and *Salpinctes*; the Solitaire, most of the Thrashers, and the Bluebirds.

Doubtless we may properly recognize as autochthonous or indigenous a half dozen genera of Sandpipers, our Prairie, Sharp-tailed and Sage Grouse, our Woodpeckers of the genera *Ceophlæus*, *Xenopicus* and *Sphyrapicus*; the Jays of the genera *Cyanocephalus* and *Cyanocitta* and probably *Aphelocoma*; the genera *Scolecophagus*, *Xanthocephalus*, and *Dolichonyx* among the Icteridæ, and among our Sparrows such genera and subgenera as *Passerella*, *Passerculus*, *Ammodramus*, *Spizella*, *Zonotrichia*, *Melospiza*, *Poocates*, *Spiza*, and *Calamospiza*; of the Warblers the genera *Mniotilta*, *Protonotaria*, *Helinaia*, *Helmitherus*, *Helminthophila*, *Sylvania*, and *Seiurus*, and many of the species of *Dendroica*; also *Galeoscoptes*, *Oroscoptes*, *Hesperocichla*, and *Hylocichla*.

As modifications of Old World or circumpolar stock may be mentioned *Camptolaimus*, *Lophodytes*, and *Chen* among Ducks and Geese, and *Picicorvus*, *Rhynchophanes*, *Hesperiphona*, and *Leucosticte* among Passeres, with of course the hundred or more species and subspecies which belong to circumpolar genera.

Probably three fourths of the distinctively North American genera and species have reached their present habitats by way of Mexico, and perhaps one fourth or less by way of the West Indies. Many of the local genera and species, as those restricted

respectively to the eastern or western sides of the continent, have originated in some part of their present habitats, at a somewhat remote period, but most of them doubtless since the retreat of the glacial ice. In earlier times the barrier separating the ranges of species occupying respectively the eastern and western parts of the United States must have been much stronger than it is at present; and it will be less doubtless a few decades hence than it is now. There is good evidence that the eastern species are gradually extending their range westward, as I have already pointed out in the case of *Colaptes auratus*, and that western species are, in some cases at least, extending their range eastward. This is doubtless in great part due to, and is certainly aided by, the westward extension of agriculture, which is so rapidly transforming regions not long ago thought to be almost irreclaimable deserts. Irrigation and tree-planting, and the general pursuits of agriculture, cannot fail to extend westward the ranges of many eastern species, as the Bobwhite and various Sparrows, and probably of many of the smaller Passeres.

PART II.—THE FAUNAL SUBDIVISIONS OF NORTH AMERICA,
CONSIDERED WITH REFERENCE TO THEIR RELATION-
SHIPS, CLASSIFICATION AND NOMENCLATURE.¹

1.—*Faunal Areas.*

In zoögeography it is necessary to recognize faunal areas varying in grade and importance, just as in zoölogy it is necessary to divide animals into groups differing in rank, as *classes*, *orders*, *families*, *genera* and *species*. The terms employed in zoögeography, however, have not been used with the same precision as the practically corresponding terms in zoölogy. Identical designations have sometimes been used in

¹ The classification and nomenclature here adopted is the same as in my recent paper on 'The Geographical Distribution of North American Mammals' (Bull. Am. Mus. Nat. Hist., Vol. IV, pp. 199-243, Dec. 1892). Also much of the matter, as regards the generalities of the subject, is the same in substance and often in phraseology. The accompanying maps are also reproduced, by permission, from the paper just cited. As that paper is not likely to be readily accessible to the majority of the readers of 'The Auk,' it is hoped that the reproduction of some matter previously published in another connection may not be considered reprehensible.

widely different senses, in accordance with the individual preferences of different writers. The terms *realm*, *region*, *kingdom*, *province*, *district*, and *fauna* have sometimes been applied by different writers to nearly the same geographical area, and each of them to divisions considered as of primary rank, while most of them have also been used for regions of secondary or still lower grade. In many cases they have been used merely in a quasi-technical sense, and there is hence difficulty in determining their claims to recognition by any rule of priority, or by frequency of use in any particular sense; so we are forced to choose mainly on grounds of appropriateness and convenience, the main thing being to secure uniformity of application. In view of this unfortunate state of affairs I attempted, in a paper on the geographical distribution of North American birds, published in 1871,¹ to devise a system of terms that should be not only appropriate, but in as close conformity as possible with previous usage. Finding that *realm* had been used by Agassiz and others for regions of the first rank, and that *region* and *province* had generally been employed for areas of secondary or lower rank, I proposed a scheme of nomenclature, which to some extent has been followed by others, but of course not fully or rigidly, since little attention has been paid to exact terminology in geographical biology. The scheme then proposed is as follows:—

For divisions of the first rank, *Realm*.

“ “ “ second rank, *Region*.

“ “ “ third “ *Province*.

“ “ “ fourth “ *Subprovince or District*.

“ “ “ fifth “ *Fauna*.

Their grade and order of sequence may be indicated by a comparison with the leading groups in zoölogy; thus *realm* would correspond in rank with *class*; *region* with *order*; *province* with *family*; *district* with *genus*; *fauna* (or *flora*, as the case may be) with *species*. It sometimes becomes convenient to recognize other divisions intermediate to these—as in zoölogy we have suborder, subfamily, subgenus, and sub-

¹ Bull. Mus. Comp. Zoöl., II, No. 3, April, 1871.

species, so we may have in zoögeography *subregions*, *subprovinces*, and even *subfaunæ*. In addition to and independent of these divisions we may also recognize *zones*. To illustrate by an example, temperate North America forms a *region* of a *realm* and includes two *subregions*, one of which is divisible into *provinces* and *subprovinces*, and some of these latter into *districts*, while each may contain several *faunæ*. It also proves desirable to subdivide the continent into a number of transcontinental belts or *zones*, which in a way coincide with the climatic zones of the physiographer.

The term *fauna* is unfortunately in current use both in a general sense and also in a restricted, taxonomic sense. In the first case it is employed to designate the animal life of a given area, geographical or political, varying in extent from a township to a continent, from a transient pool to a lake or an ocean, or in geology from a definite stratigraphic horizon to a geologic age, as the qualifying words may chance to indicate; in the second case it is a definite taxonomic term for the ultimate subdivisions of a realm, as is the term *species* for the ultimate divisions of a *class*. The term *flora* has also the same double use; and it would perhaps be futile to attempt to displace either by some specially coined substitute, to take the place of these terms when used in a specific sense for an ultimate faunal or floral area. Such an attempt, however, is perhaps unnecessary, since the qualifying prefix will rarely, if ever, leave one in doubt as to whether the term is used in a general or in a taxonomic sense.

Realms are sometimes characterized by the presence of certain orders, and usually by the presence of certain families which give to them a particular impress, and by the absence of others which in a similar way characterize other realms. Regions are usually characterized by the prevalence over them of certain genera, or even by entire families; provinces by the prevalence of particular genera or by the presence or absence of prominent species. Faunæ, on the other hand, are seldom characterized by having restricted to them any particular genera or species, but by the combination or overlapping of a number of genera and species not found elsewhere associated,—in other words, by a peculiar commingling of a considerable number of genera and species.

The transition between faunæ, between provinces, or between adjoining divisions of any grade, is rarely abrupt; it is impossible to give them absolute boundaries; yet they may be limited, in a general way, with considerable definiteness. They depend upon climatic conditions, which are in a measure determined or modified by features of topography; in other words, they are determined by the same conditions that govern the distribution of species. Hence they can seldom be bounded by geographical meridians, or by parallels of latitude, or by political boundaries; they do, however, closely coincide with certain isothermal lines, which are generally those of the season of reproduction. As temperature is influenced by altitude as well as by latitude, elevated tablelands and mountain ranges deflect the isotherms, in the northern hemisphere, far to the southward of their position over the contiguous low country, and furnish congenial homes for northern forms of animals and plants under comparatively low latitudes. Thus in the Appalachian Highlands we find northern types far to the southward of their range in the low country on either side; and the same is more strikingly apparent in the case of the Rocky Mountains, where northern types extend far down into Mexico, and in the Cascade and Sierra Nevada chain where northern types extend to southern California; isolated patches of northern life also occur on the summits of detached peaks and outlying ranges throughout the Plateau and Great Basin regions of the West. Northern and southern forms of life thus interdigitate according to elevation of the land.

While the life of the middle temperate latitudes, at ordinary levels, is so different from that of the high north on the one hand, and from that of the tropics on the other, the change is effected by a very gradual transition between the two extremes. If we suppose the life of either of the northern continents to be represented by a cube, and this cube to be composed of two blunt-edged wedges, and the two wedges so placed that one thin edge and one thick edge shall form respectively the base and the top of the cube, the two wedges would represent the fading out of the northern life southward and of the southern life northward; except that in nature the two elements are diffused through the mass instead of being segregated as in our supposed cube.

Furthermore, this northern life is largely circumpolar, so that

as we proceed northward, as in North America for example, the genera become in increasing ratio more and more those of wide distribution, till in the extreme north we meet with few that are not circumpolar. How gradually and completely this transition is made has already been shown (*antea*, p. 114), 47 per cent of the non-pelagic birds of North America occurring in corresponding latitudes in the Old World. Extra-tropical North America has, in fact, so much in common with extra-tropical Eurasia, that the two areas constitute merely two regions of a single realm.

To indicate my views in respect to the faunal relations of North America to the world at large, I will recapitulate briefly what I consider may be properly regarded as the primary life areas of the earth's surface, namely:—

(1) An *Arctic Realm*, occupying the region northward from about the limit of forest vegetation, or from about the isotherm of 32° F. It is characterized by its paucity of life and its homogeneity, nearly all its forms of both animal and vegetable life ranging throughout its whole extent.

(2) A *North Temperate Realm*, extending from the northern limit of forest vegetation to the northern border of the palm belt, or between the annual isotherms of 32° and 70° F.

(3) An *American Tropical Realm*, consisting, as the name implies, of tropical America.

(4) An *Indo-African Realm*, consisting of Africa (except the northern border), and tropical Asia and its outlying islands.

(5) A *South American Temperate Realm*, embracing extra-tropical South America.

(6) An *Australian Realm*, including not only Australia, but New Guinea, New Zealand, and the various groups of islands to the northward and eastward.

(7) A *Lemurian Realm*, consisting of Madagascar.

An eighth or *Antarctic Realm* is also sometimes recognized, as the Antarctic counterpart of the Arctic realm, though perhaps less well characterized, its fauna consisting almost exclusively of maritime and pelagic species.

The North Temperate Realm is divisible into two regions,

(1) a *North American Region*, consisting of temperate North America, and (2) a *Eurasiatic Region*, consisting of temperate Eurasia.

Before proceeding to consider the North American Region and its faunal subdivisions, a few words may be devoted to the *American Arctic*, which is here set off from the rest of North America as a part of the Arctic Realm. If North America were entirely isolated from the rest of the world, it would be quite proper to treat the American Arctic as merely a subdivision of the North American Region; but in view of the fact that it is in reality a part of a homogeneous hyperborean fauna of circumpolar distribution, it seems more in accordance with general facts to consider it as forming part of an Arctic Realm. The propriety of this seems especially emphasized when we consider that (to quote the words of Dr. Merriam) "the animals and plants inhabiting the Arctic regions are usually specifically identical throughout Arctic America, Greenland, and the polar parts of Eurasia and outlying islands," "the types inhabiting the Arctic Zone being few in number and uniform in character throughout their distribution."¹ The fauna of this Arctic Zone is thus no more American than it is Eurasiatic, and differs far more from that of the adjoining region to the southward, both in North America and Eurasia, than does the American Arctic from the Eurasian Arctic. The Arctic Realm possesses only a small number of peculiar types in proportion to its area or in comparison with the other realms, yet its ratio of peculiar types, in comparison with its meagre fauna, is by no means low. It seems an eminently natural division from the fact that its southern boundary marks the termination of forest vegetation, with which necessarily stop all the mammals, birds and insects which depend upon forests for food, shelter and a congenial home. Of the 65 genera of birds occurring in the American Arctic 60 are, as already shown, circumpolar, and 5 are American water birds that reach it for a short stay during the breeding season.

The American Arctic may be divided into two areas which may take the rank of faunæ, namely: (1) *Barren Ground*, (2) *Alaskan-Arctic*. The last has been characterized by Mr. E. W. Nelson,² and the first by me in a recently published paper on 'The Distribution of North American Mammals' (l. c. p. 220).

¹ Proc. Biol. Soc. Wash., VII, 1892, pp. 39, 40.

² Rep. Nat. Hist. Coll. in Alaska, 1887, pp. 26-32.

The exact limits of the breeding ranges of our arctic and sub-arctic birds is still very imperfectly known. Of the following list of 80 species and subspecies, a few doubtless range in the breeding season somewhat below the southern boundary of the Arctic, but for the most part they may be considered as distinctively characteristic of the Arctic fauna. A large proportion of them are either strictly circumpolar, or are represented in Eurasia by closely allied species or subspecies.

Distinctively Arctic.

(Those marked with a * are apparently confined mainly or wholly to the Eastern Arctic or Barren Ground Fauna; those marked with a † are Western or Alaskan Arctic; those with no sign prefixed are of general distribution, by far the greater part being circumpolar.)

† Urinator adamsi	† Somateria v-nigra
Urinator arcticus	Somateria spectabilis
† Urinator pacificus	Oidemia americana
Fratercula arctica glacialis	Chen hyperborea
Cepphus mandtii	Chen rossii
Stercorarius pomarinus	Anser albifrons gambeli
Stercorarius parasiticus	† Philacte canagica
Stercorarius longicaudus	Olor columbianus
Gavia alba	Crymophilus fulcarius
† Rissa tridactyla pollicaris	Phalaropus lobatus
† Rissa brevirostris	Tringa canutus
* Larus glaucus	* Tringa maritima
† Larus barrovianus	† Tringa couesi
Larus leucopterus	† Tringa ptilocnemis
† Larus glaucescens	† Tringa acuminata
* Larus kumlieni	Tringa maculata
† Larus nelsoni	* Tringa fuscicollis
* Larus marinus	† Tringa bairdii
† Larus schistisagus	Tringa alpina pacifica
Rhodostethia rosea	* Ereunetes pusillus
Xema sabinii	† Ereunetes occidentalis
† Sterna aleutica	Calidris arenaria
Fulmarus glacialis	Limosa hæmastica
† Fulmarus g. glupischa	† Limosa lapponica baueri
† Phalacrocorax pelagicus	† Heteractitis incanus
† Phalacrocorax urile	Numenius hudsonicus
† ? Eniconetta stelleri	Numenius borealis
† Arctonetta fischeri	Charadrius squatarola
* Somateria borealis	Charadrius dominicus

† Charadrius d. fulvus	Otocoris alpestris
Ægialitis semipalmata	Acanthis hornemanni exilipes
* Ægialitis hiaticula	* Acanthis linaria rostrata
Arenaria interpres	Acanthis linaria holbœlli
Arenaria melanocephalus	Plectrophenax nivalis
Lagopus lagopus	† Plectrophenax hyperboreus
Lagopus rupestris	Calcarius lapponicus
* Lagopus r. reinhardti	Calcarius pictus
Falco islandus	Anthus pensilvanicus
Falco rusticolus gyrfalco	Saxicola œnanthe
* Falco rusticolus obsoletus	

The following are arctic faunally, if not geographically, breeding mostly above timberline in the Rocky Mountains:—

Lagopus leucurus	Leucosticte atrata
Leucosticte tephrocotis	Leucosticte australis

Many other species, more properly Cold Temperate than Arctic, range into the Arctic so that the above list is by no means a complete enumeration of the American Arctic avifauna.

The North American Region (see Pl. III) consists of two *Subregions*, namely, (1) a *Cold Temperate Subregion* and (2) a *Warm Temperate Subregion*. The Cold Temperate Subregion extends across the continent from about the mean latitude of 43° northward to the limit of forests, with also a narrow prolongation southward along the Appalachian Highlands as far as northern Georgia; another in the interior along the main chain of the Rocky Mountains and its principal outliers south into Mexico; and a third along the Cascade and Sierra Nevada ranges. Its southern border also sweeps to the northward so as to exclude the great Saskatchewan Plains. In other words, the Cold Temperate coincides exactly with Dr. Merriam's 'Boreal Province' as laid down on his 'Provisional Biological Map of North America'.¹ As compared with the Arctic, it has 120 genera instead of 65, of which about 70 per cent. are circumpolar, and 30 per cent. American, showing the close connection of the life of the whole northern half of the northern hemisphere.

The following list of 213 species and subspecies includes only such as may be properly considered as distinctively characteristic of the Cold Temperate Subregion, as contrasted on the one hand

¹ N. Am. Fauna, No. 3, 1891, map 5.

with the American Arctic, and on the other with the Warm Temperate Subregion. Not all of them, however, are strictly limited to the Cold Temperate, a few ranging into the southern border of the Arctic, and a few others extending southward into the northern edge of the Warm Temperate; but their ranges, generally speaking, may be regarded as limited to the Cold Temperate. In scanning the list it should be borne in mind that this subregion extends very far southward along the principal mountain ranges of the continent.

Distinctively Cold Temperate.

Colymbus auritus	Aythya americana
Colymbus holbœlli	Aythya vallisneria
Urinator imber	Aythya marila nearctica
Urinator lumme	Aythya affinis
Fratercula arctica	Aythya collaris
Cyclorhynchus psittaculus	Glaucionetta clangula americana
Simorhynchus cristatellus	Glaucionetta islandica
Simorhynchus pygmæus	Charitonetta albeola
Simorhynchus pusillus	Histrionicus histrionicus
Synthliborhamphus antiquus	Camptolaimus labradorius
Cephus grylle	Oidemia deglandi
Alca torda	Oidemia perspicillata
Plautus impennis	Branta canadensis
Larus argentatus smithsonianus	Branta c. occidentalis
Larus delawarensis	Branta bernicla
Larus vegæ	Olor buccinator
Larus brachyrhynchus	Porzana carolina
Larus franklini	Porzana noveboracensis
Larus philadelphia	Gallinago delicata
Sterna paradisæa	Macrorhamphus griseus
Puffinus tenuirostris	Macrorhamphus scolopaceus
Oceanodroma furcata	Micropalama himantopus
Oceanodroma leucorhoa	Tringa minutilla
Sula bassana	Limosa fedoa
Phalacrocorax carbo	Totanus melanoleucus
Phalacrocorax dilophus	Totanus flavipes
Phalacrocorax d. cinnatus	Totanus solitarius
Phalacrocorax pelagicus robustus	Totanus s. cinnamomeus
Merganser americanus	Tryngites subruficollis
Merganser serrator	Dendragapus obscurus
Anas carolinensis	Dendragapus obscurus fuliginosus
Anas discors	Dendragapus obscurus richardsoni
Dafila acuta	Dendragapus canadensis

Dendragapus franklini	Perisoreus c. nigricapillus
Bonasa umbellus togata	Perisoreus obscurus
Bonasa u. umbelloides	Picicorvus columbianus
Bonasa u. sabini	Cyanocephalus cyanocephalus
Lagopus welchi	Corvus corax principalis
Lagopus lagopus alleni	Scolecophagus carolinus
Lagopus rupestris nelsoni	Coccothraustes vespertinus
Lagopus r. atkhensis	Coccothraustes v. montanus
Pediocætes phasianellus	Pinicola enucleator
Accipiter atricapillus	Leucosticte griseonucha
Accipiter a. striatulus	Carpodacus purpureus
Archibuteo sancti-johannis	Carpodacus p. californicus
Falco columbarius	Carpodacus cassini
Falco richardsoni	Loxia leucoptera
Scotiaptex cinerea	Spinus pinus
Bubo virginianus arcticus	Ammodramus princeps
Bubo virginianus saturatus	Ammodramus sandwichensis
Nyctala tengmalmi richardsoni	Ammodramus s. savanna
Nyctea nyctea	Ammodramus s. alaudinus
Surnia ulula caparoch	Zonotrichia querula
Dryobates villosus leucomelas	Zonotrichia leucophrys
Dryobates v. hyloscopus	Zonotrichia l. intermedia
Dryobates pubescens gairdneri	Zonotrichia l. gambeli
Dryobates pubescens oreæcus	Zonotrichia coronata
Picoides arcticus	Zonotrichia albicollis
Picoides americanus	Spizella monticola
Picoides a. dorsalis	Spizella m. ochracea
Picoides a. alascensis	Junco aikenii
Sphyrapicus varius	Junco hyemalis
Sphyrapicus v. nuchalis	Junco h. oregonus
Sphyrapicus thyroideus	Junco h. shufeldti
Contopus borealis	Junco h. carolinensis
Empidonax flaviventris	Junco h. thurberi
Empidonax difficilis	Junco annectens
Empidonax pusillus	Junco cinereus dorsalis
Empidonax minimus	Junco cinereus palliatus
Empidonax hammondi	Melospiza cinerea
Otocoris alpestris leucolæma	Melospiza lincolni
Pica pica hudsonius	Passerella iliaca
Cyanocitta stelleri	Passerella iliaca unalaschcensis
Cyanocitta s. frontalis	Passerella iliaca megarhyncha
Cyanocitta s. macrolopha	Passerella iliaca schistacea
Cyanocitta s. annectens	Tachycineta bicolor
Perisoreus canadensis	Tachycineta thalassina
Perisoreus c. capitalis	Ampelis garrulus
Perisoreus c. fumifrons	Lanius borealis

Vireo philadelphicus	Troglodytes h. pacificus
Helminthophila ruficapilla	Troglodytes alascensis
Helminthophila r. gutturalis	Certhia familiaris americana
Helminthophila celata	Certhia familiaris montana
Helminthophila c. lutescens	Certhia familiaris occidentalis
Helminthophila peregrina	Sitta canadensis
Dendroica tigrina	Sitta pygmæa
Dendroica cærulescens	Parus atricapillus
Dendroica coronata	Parus a. septentrionalis
Dendroica auduboni	Parus a. occidentalis
Dendroica maculosa	Parus gambeli
Dendroica castanea	Parus cinctus obtectus
Dendroica striata	Parus hudsonicus
Dendroica blackburniæ	Parus h. stoneyi
Dendroica virens	Parus rufescens
Dendroica townsendi	Regulus satrapa
Dendroica palmarum	Regulus s. olivaceus
Dendroica p. hypochrysea	Regulus calendula
Seiurus noveboracensis	Turdus aliciaë
Seiurus n. notabilis	Turdus aliciaë bicknelli
Geothlypis agilis	Turdus ustulatus
Geothlypis philadelphia	Turdus u. swainsonii
Geothlypis macgillivrayi	Turdus aonalaschkæ
Sylvania pusilla	Turdus a. auduboni
Sylvania p. pileolata	Turdus a. pallasii
Sylvania canadensis	Hesperocichla nævia
Cinclus mexicanus	Sialia arctica
Troglodytes hiemalis	

Of the above list of 213 species and subspecies, about 20 are maritime, about 60 range across the continent, and about 130 have a more limited range. Of these a small number is limited to the immediate vicinity of the Northwest Coast, a few to the Upper Missouri region, and a large number to the Rocky Mountain plateau and the various mountain ranges of the western half of the continent.

The Cold Temperate Subregion has been divided into four *faunæ*, as follows: (1) *Hudsonian*, (2) *Canadian*, (3) *Aleutian*, (4) *Sitkan*. The first two have been long recognized, and their boundaries are well known. They were first mapped by Dr. Merriam¹ in 1890, and more recently by the

¹ North American Fauna, No. 3, map 5.

present writer,¹ on practically the same lines. The last two were first defined by Mr. E. W. Nelson² as respectively the 'Sitkan District' and the 'Aleutian District,' and re-defined and mapped in my recent paper on the 'Geographical Distribution of North American Mammals.'³ As noted later in the present paper (p. 139), there remain to be defined, when our knowledge of the subject becomes sufficiently detailed, a series of local mountain faunæ in the Rocky Mountains and other principal mountain chains in the West.

The *Warm Temperate Subregion* occupies middle North America, extending from the southern boundary of the Cold Temperate Subregion, as defined above, to the northern edge of the American Tropical Realm (see Pl. III). It is thus geographically the same as Dr. Merriam's 'Sonoran Province.' It includes the greater part of the United States, Lower California, and the Mexican tableland. It is cut into along the principal mountain systems by the southern prolongations of the Cold Temperate Subregion, and also extends northward over the Saskatchewan Plains. The extreme southern parts of the peninsulas of Florida and Lower California, however, are excluded, as also the lower coast region of Texas, these excluded districts, though of comparatively small extent, belonging to the Tropical Realm.

The Warm Temperate Subregion contrasts strongly with the Cold Temperate in respect to its topographic and climatic features, as well as in its faunal aspects. Aside from the very marked difference of temperature between the two, the Cold Temperate is a homogeneous region, covered almost continuously with principally coniferous forests; and aside from its southern extension along the mountain ranges, presents little diversity in topography. The Warm Temperate, on the other hand, is highly diversified topographically, and consequently in climate, especially in respect to rainfall, which of course greatly modifies the distribution of forests, and of plants in general, which in turn exerts a marked influence upon the distribution of animal life. We have hence conditions favorable for the development of

¹ Bull. Am. Mus. Nat. Hist., IV, 1892, pl. viii.

² Rep. Nat. Hist. Coll. made in Alaska, 1887, pp. 24-27.

³ Bull. Am. Mus. Nat. Hist., IV, 1892, pp. 223, 224, pl. viii.

locally restricted types, including families as well as genera and species, to say nothing of merely geographical races or subspecies. Consequently it is divisible into a larger number of faunal areas, varying to a much greater extent as regards their relative taxonomic rank, and much more strongly contrasted in respect to their faunal characteristics.

The Warm Temperate Subregion may be considered as primarily divisible along a nearly north and south line into two *Provinces*, namely (1) an eastern or *Humid Province* and (2) a western or *Arid Province*. The Humid Province extends from the Atlantic coast westward to about the 100th meridian, or to the eastern border of the Great Plains, exclusive, of course, of the Appalachian Highlands; the Arid Province extends thence westward to the Pacific coast, exclusive, of course, of the southward extensions of the Cold Temperate along the mountain systems. These regions thus correspond respectively with Dr. Merriam's 'Humid Sonoran' and his 'Arid Sonoran,' as he originally defined them. The Humid Province, as the name implies, has a rather moist climate and is (or was a century ago) in most parts heavily forested; the Arid Province is, on the other hand, a region of open plains and deserts, with, in general, an excessively arid climate.

These two provinces thus coincide with the two strongly marked regions of the middle portion of North America in respect to climate as modified by rainfall. The line of separation is thus meridional instead of transcontinental as are the faunal boundaries determined by temperature. In this case temperature, as a controlling influence in the distribution of animals and plants, is subordinated to the usually less powerful agent, humidity.

The transition between the Humid and Arid Provinces is nowhere abrupt; they gradually merge into each other everywhere along their line of junction, as the prairies of the Mississippi Valley gradually become more arid and take on the characteristic aspect of the plains. There is thus here the usual 'transition' belt occurring between contiguous faunal areas. It is, however, rather broader than between regions where temperature is primarily the limiting influence, as in the case of boundaries trending in a nearly east and west direction, the transition being first from a forested region to one of fertile prairies, and thence to arid

plains and deserts. The dividing line may be considered as coincident with the isohyetal curve marking an annual rainfall of 20 inches or less, as shown on the rainfall charts of the United States, — in other words, as already stated, near the 100th meridian.

The contrasting climatic conditions of these two regions are due to peculiar physiographic and geographic conditions which extend back to a comparatively remote period — so remote as to have given time for the development of many generic forms limited almost entirely to one or the other of these two regions. Thus, in respect to birds, we have 17 genera in the Humid Province which do not range to any great extent into the Arid Province, and 28 genera in the Arid Province which are not found to any extent in the Humid. The distinctively eastern or Humid Province genera are:—

Philohela	Ictinia	Protonotaria
Bartramia	Dolichonyx	Helinaia
Colinus	Quiscalus	Helmitherus
Tympanuchus	Ammodramus ¹	Compsothlypis
Catharista	Spiza	Galeoscoptes
Elanoides	Mniotilta	

A few of these genera range into the eastern border of the Plains, and sometimes, as in the case of *Galeoscoptes*, occur locally westward to the Pacific coast. They are nevertheless to be regarded as distinctively characteristic of the eastern side of the continent. *Colinus* is more difficult to locate, as southern forms of the genus occur in the Sonoran Subprovince of the Arid, while its northern form, *C. virginianus*, is distinctively an eastern form characteristic of the Humid Province.

On the other hand, the following genera may in like manner be considered as distinctively characteristic of the Arid Province, although some of them range northward into the Cold Temperate:—

Æchmophorus	Pediocætes	Micropallas
Oreortyx	Centrocerus	Geococcyx
Callipepla	Pseudogryphus	Xenopicus
Cyrtonyx	Glaucidium	Phalænoptilus

¹ Subgenus.

Cypseloides	Amphispiza	Chamæa
Aëronautæ	Calamospiza	Psaltriparus
Selasphorus	Phainopepla	Auriparus
Xanthocephalus	Salpinctes	Myiadestes
Calcarius	Catherpes	
Rhyncophanes	Oroscoptes	

Were we to include in this connection some 38 additional tropical genera which range only a short distance into the Warm Temperate, as here defined, we should have to add 7 genera to the eastern list and about 30 to the western list. In other words, out of a total of about 150 genera distinctive of the Warm Temperate,¹ about 65, or 43 per cent., have a transcontinental distribution, and about 85, or 57 per cent., are either eastern or western.

The higher ratio of peculiar types in the Arid Province as compared with the Humid Province is obviously due to geographic conditions, the Arid Province adjoining at the southward a broad tropical land area, while the southern boundary of the Humid Province is formed by the Gulf of Mexico. A large proportion of the genera peculiar to either the Humid or Arid Provinces range across the whole north and south breadth of the Warm Temperate Subregion.

The northern half of the Warm Temperate, however, also differs faunally quite markedly from the southern half, in consequence of the extension southward of a few northern genera over most of its northern half, and the extension northward of many tropical genera over a portion of its southern half. As regards birds, while a considerable list of species would fall respectively into one or the other of these two categories, the number of genera is small, owing to the fact that if we take them on the basis of their transcontinental range their representation is often very different in the two provinces, as regards both their geographical distribution and the species which represent them. The northern list would include perhaps such genera as *Botaurus* (excluding *Butorides*), *Bonasa*, *Passerculus* (subgenus), and perhaps *Tachycineta* and *Ampelis*, and in the East *Carpodacus* and *Merula*; although most of these are really Cold

¹ Cosmopolitan and other wide-ranging genera are not included in this connection, but only such as are distinctively American.

Temperate rather than Warm Temperate forms. The southern list would include a large number of tropical genera which range into the southern part of the Warm Temperate—such for instance as *Columbigallina*, *Scardafella*, *Urubitinga*, *Asturina*, *Geococcyx*, *Conurus*, *Nyctidromus*, various genera of Hummingbirds, *Milvulus*, *Pyrocephalus*, *Campylorhynchus*, *Catherpes*, etc.; but they are nearly all limited to the Arid division of the Warm Temperate, and thus serve to emphasize the differences distinguishing the Arid from the Humid Province quite as much as a northern and southern division along a transcontinental line. The differentiation of the Warm Temperate into two transcontinental belts—a northern and a southern—is thus due to the increase of tropical forms near the southern border, in accordance with the law of general increase of the forms of life from the north southward.

In respect to species and subspecies, the following lists may serve to indicate the forms characteristic respectively of the Humid and Arid Provinces. As the transition between the two is gradual, with many interdigitations, through the extension of forest or tree-loving species up the partially wooded river valleys into the Plains, the lists are to some degree open to the criticism that many species classified as eastern are not sharply limited at the eastern edge of the Plains, and that a few of the properly Arid Province species range eastward to the prairies east of the Mississippi River, yet in general terms the distribution is as implied in the headings of the two lists. The straggling of Catbirds and Kingbirds to the Great Basin, and even to the Pacific coast, does not weigh heavily against the propriety of including them in the Humid Province list since they are here such characteristic elements of the fauna. The lists, furthermore, are not intended to be complete; to save space subspecies are in many instances omitted; the more tropical forms, and generally also those of local distribution, as well as the maritime water birds, are excluded.

Humid Province.

<i>Ajaja ajaja</i>	<i>Ardea cœrulea</i>
<i>Guara alba</i>	<i>Nycticorax violaceus</i>
<i>Ardea rufescens</i>	<i>Rallus elegans</i>
<i>Ardea tricolor ruficollis</i>	<i>Ionornis martinica</i>

Philohela minor	Cardinalis cardinalis
Symphemia semipalmata	Guiraca cærulea
Ægialitis meloda	Habia ludoviciana
Colinus virginianus	Passerina cyanea
Tympanuchus cupido	Passerina ciris
Tympanuchus americanus	Piranga rubra
Meleagris gallopavo	Piranga erythromelas
Columbigallina passerina	Lanius ludovicianus
Catharista atrata	Vireo flavifrons
Elanoides forficatus	Vireo solitarius
Ictinia mississippiensis	Vireo noveboracensis
Buteo lineatus	Protonotaria citrea
Buteo latissimus	Helinaia swainsonii
Syrnium nebulosum	Helmitherus vermivorus
Megascops asio	Helminthophila pinus
Conurus carolinensis	Helminthophila chrysoptera
Dryobates villosus	Helminthophila bachmani
Dryobates borealis	Dendroica cærulea
Melanerpes erythrocephalus	Dendroica pennsylvanica
Melanerpes carolinus	Dendroica dominica
Antrostomus vociferus	Dendroica kirtlandi
Antrostomus carolinensis	Dendroica vigorsii
Tyrannus tyrannus	Dendroica discolor
Tyrannus dominicensis	Seiurus aurocapillus
Myiarchus crinitus	Seiurus motacilla
Sayornis phæbe	Geothlypis trichas
Contopus virens	Geothlypis formosa
Empidonax acadicus	Icteria virens
Otocoris alpestris praticola	Sylvania mitrata
Cyanocitta cristata	Galeoscoptes carolinensis
Aphelocoma floridana	Harporhynchus rufus
Corvus ossifragus	Thryothorus ludovicianus
Dolichonyx oryzivorus	Thryothorus bewickii
Molothrus ater	Troglodytes ædon
Sturnella magna	Cistothorus palustris
Agelaius phœniceus	Cistothorus stellaris
Quiscalus major	Sitta carolinensis
Quiscalus quiscula	Sitta pusilla
Ammodramus savannarum	Parus bicolor
Chondestes grammacus	Parus carolinensis
Spizella pusilla	Poliophtila cærulea
Peucæa æstivalis	Turdus mustelinus
Melospiza fasciata	Turdus fuscescens
Pipilo erythrophthalmus	Sialia sialis

Arid Province.

<i>Anas cyanoptera</i>	<i>Chordeiles virginianus henryi</i>
<i>Dendrocygna fulva</i>	<i>Chordeiles acutipennis texensis</i>
<i>Dendrocygna autumnalis</i>	<i>Cypseloides niger</i>
<i>Plegadis guarauna</i>	<i>Chætura vauxi</i>
<i>Symphemia s. inornata</i>	<i>Aëronautes melanoleucus</i>
<i>Ægialitis meloda circumcincta</i>	<i>Trochilus alexandri</i>
<i>Ægialitis nivosa</i>	<i>Selasphorus rufus</i>
<i>Ægialitis montana</i>	<i>Selasphorus alleni</i>
<i>Callipepla squamata</i>	<i>Selasphorus platycercus</i>
<i>Callipepla gambeli</i>	<i>Calypte anna</i>
<i>Callipepla californica</i>	<i>Tyrannus verticalis</i>
<i>Oreortyx pictus</i>	<i>Tyrannus vociferans</i>
<i>Colinus virginianus texensis</i>	<i>Myiarchus mexicanus</i>
<i>Pediocætes phas. columbianus</i>	<i>Myiarchus cinerascens</i>
<i>Pediocætes phas. campestris</i>	<i>Sayornis saya</i>
<i>Tympanuchus pallidicinctus</i>	<i>Sayornis nigricans</i>
<i>Meleagris gallopavo ellioti</i>	<i>Contopus richardsonii</i>
<i>Meleagris gallopavo mexicanus</i>	<i>Contopus pertinax</i>
<i>Columba fasciata</i>	<i>Empidonax wrightii</i>
<i>Columbigallina p. pallescens</i>	<i>Empidonax fulvifrons</i>
<i>Pseudogryphus californianus</i>	<i>Otocoris alpestris (subsp.)</i>
<i>Buteo borealis calurus</i>	<i>Aphelocoma woodhousei</i>
<i>Buteo borealis harlani</i>	<i>Aphelocoma californica</i>
<i>Buteo lineatus elegans</i>	<i>Aphelocoma sieberi arizonæ</i>
<i>Archibuteo ferrugineus</i>	<i>Corvus caurinus</i>
<i>Falco mexicanus</i>	<i>Molothrus ater obscurus</i>
<i>Syrnium occidentale</i>	<i>Xanthocephalus xanthocephalus</i>
<i>Megascops asio (subsp.)</i>	<i>Sturnella magna neglecta</i>
<i>Megascops flammeolus</i>	<i>Agelaius phæniceus sonoriensis</i>
<i>Speotyto cunicularia hypogæa</i>	<i>Agelaius gubernator</i>
<i>Glaucidium gnoma</i>	<i>Agelaius tricolor</i>
<i>Micropallas whitneyi</i>	<i>Icterus bullocki</i>
<i>Geococcyx californianus</i>	<i>Icterus cucullatus (subsp.)</i>
<i>Dryobates villosus (subsp.)</i>	<i>Icterus parisorum</i>
<i>Dryobates nuttalli</i>	<i>Scolecophagus cyanocephalus</i>
<i>Dryobates scalaris</i>	<i>Carpodacus mexicanus frontalis</i>
<i>Dryobates arizonæ</i>	<i>Spinus psaltria</i>
<i>Xenopicus albolarvatus</i>	<i>Calcarius ornatus</i>
<i>Melanerpes torquatus</i>	<i>Rhyncophanes mccownii</i>
<i>Melanerpes formicivorus bairdi</i>	<i>Poocætes gramineus confinis</i>
<i>Melanerpes uropygialis</i>	<i>Ammodramus s. perpallidus</i>
<i>Colaptes cafer</i>	<i>Ammodramus h. occidentalis</i>
<i>Colaptes chrysoides</i>	<i>Chondestes grammacus strigatus</i>
<i>Phalænoptilus nuttalli</i>	<i>Spizella pusilla arenacea</i>
<i>Antrostomus vociferus arizonæ</i>	<i>Spizella pallida</i>

<i>Spizella breweri</i>	<i>Geothlypis trichas occidentalis</i>
<i>Spizella atrigularis</i>	<i>Icteria virens longicauda</i>
<i>Amphispiza bilineata</i>	<i>Oroscoptes montanus</i>
<i>Amphispiza belli</i>	<i>Harporhynchus longirostris</i>
<i>Peucaea cassini</i>	<i>Harporhynchus curvirostris</i>
<i>Peucaea carpalis</i>	<i>Harporhynchus bendirei</i>
<i>Peucaea ruficeps</i>	<i>Harporhynchus lecontei</i>
<i>Melospiza fasciata</i> (subsp.)	<i>Harporhynchus crissalis</i>
<i>Pipilo maculatus</i> (subsp.)	<i>Salpinctes obsoletus</i>
<i>Pipilo fuscus</i>	<i>Catherpes mexicanus</i>
<i>Pipilo aberti</i>	<i>Campylorhynchus brunneicapillus</i>
<i>Pipilo chlorurus</i>	<i>Thryothorus ludovicianus</i> (subsp.)
<i>Cardinalis cardinalis</i> (subsp.)	<i>Thryothorus bewickii</i> (subsp.)
<i>Pyrhuloxia sinuata</i>	<i>Troglodytes aëdon</i> (subsp.)
<i>Guiraca caerulea eurhyncha</i>	<i>Cistothorus palustris paludicola</i>
<i>Habia melanocephala</i>	<i>Sitta carolinensis aculeata</i>
<i>Passerina amœna</i>	<i>Sitta pygmæa</i>
<i>Passerina versicolor</i>	<i>Parus bicolor texensis</i>
<i>Calamospiza melanocorys</i>	<i>Parus inornatus</i>
<i>Piranga rubra cooperi</i>	<i>Parus atricristatus</i>
<i>Piranga ludoviciana</i>	<i>Parus wollweberi</i>
<i>Phainopepla nitens</i>	<i>Parus carolinensis agilis</i>
<i>Lanius ludovicianus</i> (subsp.)	<i>Chamæa fasciata</i>
<i>Vireo solitarius</i> (subsp.)	<i>Psaltiriparus lloydi</i>
<i>Vireo atricapillus</i>	<i>Psaltiriparus minimus</i>
<i>Vireo belli</i>	<i>Psaltiriparus plumbeus</i>
<i>Vireo huttoni</i>	<i>Psaltiriparus santaritæ</i>
<i>Vireo vicinior</i>	<i>Auriparus flaviceps</i>
<i>Helminthophila luciae</i>	<i>Polioptila caerulea obscura</i>
<i>Helminthophila virginiae</i>	<i>Polioptila plumbea</i>
<i>Dendroica graciae</i>	<i>Polioptila californica</i>
<i>Dendroica chrysoparia</i>	<i>Myiadestes townsendi</i>
<i>Dendroica nigrescens</i>	<i>Turdus fuscescens</i> (subsp.)
<i>Dendroica occidentalis</i>	<i>Sialia mexicana</i>

A careful tabulation of the thousand or more species and subspecies of North American birds shows that about 400 occur in the Warm Temperate Subregion that do not extend much to the northward of its northern border, and which may be hence termed distinctively Warm Temperate species. This excludes about 75 essentially tropical species and subspecies which range into the southern border of the United States, and also about 86 wide-ranging species whose habitats either broadly overlap both subregions or have even a much greater distribution and are thus not properly distinctive of either the Cold Temperate or the Warm Temperate.

Of the 400 essentially Warm Temperate forms only about 6 per cent. have a transcontinental range; about 25 per cent. may be considered as having a more or less general dispersion over the Humid Province, to which they are restricted, and about 44 per cent. range more or less at large over the Arid Province, to which they are practically confined. The remaining 25 per cent. are of more or less local distribution, part being water birds confined to certain portions of the Atlantic, Pacific or Gulf coasts; part are more or less maritime land birds, while a few are limited to particular areas of comparatively small extent in the interior, or to a narrow belt along the Pacific coast. As will be noted later, some 28 species and 24 subspecies are confined to Lower California and its outlying islands.

The northern and southern differentiation of the Warm Temperate noted above serves, however, as a basis for primary subdivisions (secondary divisions of the Warm Temperate) of both the Humid and Arid provinces, each being separable into two *Subprovinces* (see Pl. IV). Thus the Humid Province is divisible into (1) an *Appalachian Subprovince*, consisting of the long recognized Alleghanian and Carolinian Faunæ, and (2) an *Austroriparian Subprovince*, consisting of the Louisianian Fauna, as commonly recognized. The Austroriparian Subprovince is Dr. Merriam's 'Louisianian or Austroriparian sub-region' of his 'Sonoran' region; the Appalachian Subprovince is the northeastern part of his 'Sonoran,' left by him as an unnamed remainder after setting off and naming as 'subregions' all the other parts of his 'Sonoran Region.' The line separating these two subprovinces marks the southern limit of several northern genera and many northern species, and the northern limit of a still greater number of southern genera and species.

The Humid Province comprises three *faunæ*, as follows: (1) *Alleghanian*, (2) *Carolinian*, (3) *Louisianian*. These faunæ have been so long recognized, and have recently been so well mapped by Dr. Merriam,¹ that a detailed account of them may be here omitted.

The Arid Province not only extends, as already stated, from the eastern edge of the Great Plains to the Pacific coast, but also northward over the Saskatchewan Plains, the Plains of the Colum-

¹ N. Am. Fauna, No. 3, map 5.

bia, and thence northward into southern British Columbia. It thus includes the so-called 'Central' and 'Pacific' Provinces of Baird and most subsequent writers, excepting of course the more elevated parts of the Rocky Mountain plateau. It is thus coëxtensive with Dr. Merriam's 'Arid Sonoran.' While it is true that a narrow belt along the Pacific coast, from southern California northward to the Alaskan Peninsula, possesses a few peculiar types, and lacks a few of those occurring in the region immediately to the eastward, the differentiation is on the whole too slight to give the Pacific coast district the rank of a region coördinate in grade with the formerly so-called Middle and Eastern Provinces. These differences serve at best merely to mark off from the interior region at large a tier of narrow coast faunæ of the same grade as those bordering the Atlantic coast, although the latter, owing to the widely different physiography of the eastern and western borders of the continent, have a much greater east and west extent.

The Arid Province, like the Humid, is divisible into two *sub-provinces*, namely, (1) a northern or *Campestrian Subprovince*, and (2) a southern or *Sonoran Subprovince* (see Pl. IV). These two regions correspond respectively with Dr. Merriam's 'Arid Upper Sonoran' and his 'Arid Lower Sonoran'; just as the two sub-provinces of the Eastern Province correspond with his 'Humid Upper Sonoran' and 'Humid Lower Sonoran,' as laid down on his 'Second Provisional Bio-geographic Map of North America,' except that the 'humid' and 'arid' portions of his 'Transition Zone'¹ are also included respectively in the Alleghanian and Campestrian Subprovinces. The Sonoran Subprovince is equal to Dr. Merriam's restricted 'Arid or Sonoran subregion proper' plus his 'Lower Californian subregion,' while the Campestrian Subprovince includes his 'Great Basin subregion' and his 'Great Plains subregion.'² The name 'Campestrian' has reference to the fact that this subprovince is largely made up of plains, including as it does the greater part of the Great Plains, the Plains of the Saskatchewan, and the Plains of the Columbia and Snake Rivers.

Many species are limited in their southward distribution by the southern border of the Campestrian Subprovince, but few genera

¹ Cf. Proc. Biol. Soc. Washington, VII, 1892, pp. 26-33, and accompanying map.

² Cf. N. Am. Fauna, No. 3, 1890, p. 25.

appear to be thus restricted. This boundary also forms about the northern limit of many species and genera of the Sonoran Subprovince. These two subprovinces are hence characterized mainly by the presence of a large number of forms found in the Sonoran which are absent from the Campestrian, and are thus distinguished, like many northern divisions when compared with adjoining southern ones of coördinate rank, from the Arctic southward, by what they lack rather than by the possession of any peculiar types.

The Campestrian Subprovince itself may be divided into three areas which may be termed *districts*, namely (1) the *Great Plains District*, (2) the *Great Basin District*, and (3) the *Pacific Coast District*. (See Pl. IV.) The first two are respectively the 'Great Plains subregion' and the 'Great Basin subregion' of Dr. Merriam's first 'Biological Map of North America.'¹ Although these two districts are separated by the main chain of the Rocky Mountains, they are faunally but slightly differentiated. But few genera occur in the one that do not occur in the other; a few species, and a larger number of subspecies are restricted to one or the other during the breeding season, but they often become more or less mixed during winter, when they meet on common ground in the Sonoran Subprovince. Thus the Rocky Mountains, while forming so imposing a feature in the configuration of the continent, fail to be by any means an impassable barrier to the dispersal of species, owing to their numerous comparatively low depressions, and to their meridional trend.

The Pacific Coast District consists of a narrow belt situated mainly west of the Sierra Nevada and Cascade Ranges, and is characterized by the presence of a few species and a considerable number of subspecies mainly restricted to it.

The Sonoran Subprovince consists of Dr. Merriam's restricted 'Sonoran subregion,'¹ with the addition of Lower California, which Dr. Merriam gave the rank of a 'subregion.' A careful synopsis of the bird life of Lower California and its outlying islands shows that it has 28 species and 24 subspecies which are not found in the United States. Of the 29 species 10 are confined exclusively to the outlying islands, and 9 others are either strictly

¹ N. Am. Fauna, No. 3, 1890, p. 25, and map 5.

maritime or pelagic. Of the 10 peculiar land birds, all but one are congeneric with and for the most part closely allied to North American species. Of the 24 subspecies, 23 are merely local races of North American species. A number of these peculiar species and subspecies are confined to the subtropical portions of the region below La Paz, which belongs to the American Tropical Realm rather than to the Temperate Realm, thus leaving very little of distinctive importance for the non-tropical portion of the Peninsula.

It is at present impracticable to attempt to define in detail the numerous faunæ of the Arid Province. While certain portions might be thus treated, our knowledge of the region as a whole is too defective to warrant even a provisional subdivision into faunæ. The same is true also of the southern prolongations of the Cold Temperate along the mountain ranges of the western half of the continent. It is evident, without going into a detailed analysis, that many of the wide-ranging species that prevail over and give character to the Arctic, Hudsonian, and Canadian Faunæ, respectively, are absent from the Rocky, the Cascade, and the Sierra Nevada ranges and their outlying spurs; also that many eastern forms are here replaced by more or less closely related western forms, and that quite a number of peculiar mountain types are superimposed upon this new combination. The case is obviously quite different from the conditions met with in the Alleghanies, where merely a small percentage of Canadian forms occur far to the southward of where they are found in the contiguous lowlands. To give due expression to the faunal conditions met with, for example, in the Rocky Mountains south of the Canadian Pacific Railroad, it evidently will be necessary to recognize a succession of mountain faunæ as we go southward, as well as in descending from timber-line at any given point to the foot-hills. Dr. Merriam, in defining the life zones at high elevations in Arizona, Idaho, and California, has made an excellent beginning in this comparatively new line of work, and we may confidently look forward to still more important results from the great mass of unpublished data he has so industriously brought together. The proper collation of our mountain areas, from the British boundary across the United States into Mexico, will be a work of exceptional interest and importance, and will require much additional field research.

As already noted, the extreme southern portions of North America belong to the American Tropical Realm, which consists of tropical America at large. It thus includes not only a large part of South America, Central America and the West Indies, but the lowlands of Mexico, including the low eastern coast region to some distance north of the mouth of the Rio Grande, and the low western coast to some distance north of Mazatlan. To the Tropical Realm belong also the extreme southern portion of the peninsula of Lower California, and the extreme southern portion of the peninsula of Florida. There are thus three small portions of 'North America,' as defined in the A. O. U. Check-List, which belong with the Tropical rather than to the North Temperate Realm.¹

The fauna of neither of the tropical areas within the United States is typically tropical, but the infusion of tropical elements is so great as to render them tropical rather than temperate. They have also little in common with each other, as would be naturally anticipated from their wide geographical separation through the interposition of the Gulf of Mexico, thus preventing a tropical land connection. Consequently the Floridian area, or the *Floridian Fauna*, as it has long been technically known,² belongs to the Antillean Region of the American Tropical, while the Texan area is an outlying arm of the Central American Region of the American Tropical. The tropical portion of Lower California also belongs to the Central American Region.

The Floridian Fauna has recently been treated in much detail by Dr. Merriam,³ and hence need not be considered at length here. The following birds, however, may be mentioned as among those distinctively characteristic of this limited area, though having generally a very extended range into tropical America.

¹ See maps, plates III and IV, where the uncolored portions to the south of the colored areas belong to the Tropical Realm. The uncolored portion at the top of plate III may be taken as representing that portion of the continent belonging to the Arctic.

² Cf. Bull. Mus. Comp. Zool., II, 1871, p. 391. — The general provisional northern limit here given—"near the latitude of Lake George"—proves to have been carried a little too far north, its limits as now recognized being Cape Malabar on the east coast and Tampa Bay on the west coast. (Cf. Merriam, Proc. Biol. Soc. Washington, VII, 1892, p. 33.)

³ Cf. Merriam, Proc. Biol. Soc. Washington, VII, 1892, pp. 52-54.

<i>Sula sula</i>	<i>Polyborus cheriway</i>
<i>Fregata aquila</i>	<i>Speotyto cunicularia floridana</i>
<i>Phœnicopterus ruber</i>	<i>Crotophaga ani</i>
<i>Ardea occidentalis</i>	<i>Coccyzus minor maynardi</i>
<i>Aramus giganteus</i>	<i>Euethia bicolor</i>
<i>Columba leucocephalus</i>	<i>Ammodramus nigrescens</i>
<i>Zenaida zenaida</i>	<i>Vireo altiloquus barbatulus</i>
<i>Rostrhamus sociabilis</i>	<i>Cœreba bahamensis</i>
<i>Buteo brachyurus</i>	

The semi-tropical area occupying the extreme lower portion of the Rio Grande Valley and extending as a narrow belt thence northward for a short distance along the Texas coast, and also southward along the Mexican coast to the neighborhood of Tampico, I have recently designated¹ as the *Tamaulipan Fauna*. Among the birds that extend northward from the tropics to find here about their northern limit are the following:—

<i>Podiceps dominicus</i>	<i>Myiozetetes texensis</i>
<i>Ortalis vetula macalli</i>	<i>Xanthoura luxuosa</i>
<i>Engyptila albifrons</i>	<i>Embernagra rufivirgata</i>
<i>Buteo albicaudatus</i>	<i>Sporophila morelleti sharpei</i>
<i>Crotophaga sulcirostris</i>	<i>Euphonia elegantissima</i>
<i>Trogon ambiguus</i>	<i>Vireo flavoviridis</i>
<i>Nyctidromus albigollis merrilli</i>	<i>Compsothlypis nigrilora</i>
<i>Amazilia fuscicaudata</i>	<i>Geothlypis poliocephala palpebralis</i>
<i>Amazilia cerviniventris</i>	<i>Basileuterus culicivorus</i>
<i>Pitangus derbianus</i>	<i>Harporhynchus longir. sennetti</i>

The Tamaulipan Fauna has fewer distinctively tropical types than would be expected from its low altitude and geographical position. This is doubtless due to the extreme aridity of the country, since in the forest regions further inland under the same parallels Trogons, Motmots and Parrots occur to a much greater extent than in the arid, nearly treeless coast region.

The extreme southern portion of Lower California, from about La Paz southward, may be considered as fairly subtropical, but contains, on the whole, comparatively few distinctively tropical types of birds. Among such may perhaps be placed the following:—

¹ Bull. Am. Mus. Nat. Hist. IV, p. 241, Dec. 1892.

Glaucidium hoskinsi
Crotophaga sulcirostris
Dryobates scalaris lucasanus
Basilinna xantusi
Empidonax cineritius
Empidonax griseus

Dendroica bryanti
Geothlypis beldingi
Harporhynchus cinereus
Campylorhynchus affinis
Merula confinis

A few additional subspecies of northern forms also characterize the subtropical portion of the peninsula, which may perhaps well bear the name *Saint Lucas Fauna*.

Independently of the subdivisions already enumerated, and in addition to them, North America may be divided into a number of transcontinental belts or *Zones* in accordance with the climatic conditions prevailing over the different parts of the continent. Several of these zones have been repeatedly recognized by various writers on the distribution of animals and plants. A division of extra-tropical North America into about seven zones will greatly facilitate the correlation of the faunæ of different regions. These are, (1) the Arctic or Hyperborean Zone, equivalent to the American portion of the Arctic Realm; (2) the Subarctic or Hudsonian Zone; (3) the Cold Temperate or Canadian Zone; (4) the North Warm Temperate or Alleghanian Zone; (5) the Middle Warm Temperate or Carolinian Zone; (6) the South Warm Temperate or Louisianian Zone; (7) the Subtropical or Floridian Zone.¹ Dr. Merriam has already in his recent papers on the distribution of North American mammals distinguished these zones more or less definitely in treating of the life zones of the San Francisco Mountain region in Arizona and in Idaho. He has done much also toward correlating the life zones of mountain faunas with the long recognized faunæ of the Atlantic Coast. Much further information is required before these zones can be geographically defined over the western half of the continent.

In selecting names for their designation several alternatives present themselves, as for example, names derived from the climatic zones, or from some leading characteristic, as 'Spruce

¹ This is a modification of my recently published classification (Bull. Am. Mus. Nat. Hist., IV, p. 240), rendered necessary from the evident desirability of reserving the term 'Subtropical Zone' for the designation of the most northern belt of the Tropical Realm, instead of applying it to the lowest or most southern belt of the Temperate Realm, as is done when it is used for the Louisianian Zone.

Zone' for the Hudsonian, 'Arctic-alpine' for treeless mountain summits equivalent in character to the Arctic, etc., or from those of the Atlantic coast faunæ. This latter method has the merit of at once suggesting a well-known standard of comparison when applied to belts in the interior or on the Pacific coast, representative of the commonly recognized faunæ of the Atlantic coast.

Dr. Merriam has already recognized the equivalents of the Arctic, Hudsonian, Canadian, Alleghanian, etc., in portions of the mountainous districts of the West, and has presented in substance the following correlations.¹

<i>Zone.</i>	<i>Fauna.</i>
Alpine	} Arctic.
Subalpine or Timber-line	
Hudsonian or Spruce	Hudsonian.
Canadian or Fir	Canadian.
Neutral or Pine	Alleghanian.
Piñon or Cedar	[Carolinian].
Desert	[Louisianian].

2. *Classification and Nomenclature.*

A few words in regard to the names chosen for the several major divisions of the North American Region, and the choice of names in general in bio-geography. It is natural that the influences controlling the geographical distribution of life, namely, climate, and hence the principal climatic zones, should suggest the names of many of the larger ontological regions; and we find that to a large extent such names have been chosen, as by Dana, in 1852, in discussing the distribution of marine life, and by botanists generally, and notably by German writers. For the lesser regions geographical names, as Hudsonian, etc., are admirably appropriate when suggestive of some characteristic portion of the region in question. Whenever feasible, names first given should be retained in preference to later names.

In concluding this paper a few words of explanation are necessary in relation to various points of nomenclature and classification. In comparing the present scheme of faunal areas of North

¹ N. Am. Fauna, No. 3, 1890, pp. 7-34, and maps 1-4; *ibid.*, No. 5, 1891, pp. 9-12, 21-25.

America with those employed by Dr. Merriam in his recent well-known admirable papers on the geographical distribution of North American mammals, so frequently cited in the preceding pages, it will be noticed that there is a striking agreement in their number and boundaries, although a few new minor divisions have here been introduced; yet the terms employed for their designation are to a great extent different. As already intimated, the present system of classification and nomenclature is a further development of that first instituted by me in 1871, and used later in 1878, and now carried out in greater detail and extended to the whole North American Continent. The present revision of the subject is therefore not to be looked upon as unfriendly criticism of Dr. Merriam's classification and nomenclature, which he evidently adopted provisionally,¹ selecting such terms as would suffice to clearly indicate the areas under discussion; his attention was given mainly and most successfully to an elucidation of the facts of distribution; a detailed consideration of the nomenclature of the subject was outside of his special field.

In attempting to establish a consistent scheme of classification and terminology, the aim is to assign definite terms for areas of similar taxonomic grade. Many of the terms in more or less current use have been employed so loosely, and used in so many different senses by different writers, that, as already said, a strict 'rule of priority' cannot be enforced, at least without leading in many instances to very unsatisfactory and inharmonious results. As already explained, the system here adopted is analogous to the schemes followed in systematic biology and stratigraphic geology. In the selection of names for the higher divisions, reference has been had to the influences controlling the geographic distribution of life, namely, *climate*, and the climatic zones have been allowed to suggest the names of many of the major ontological areas. Indeed, such names have been employed before in nearly the same sense, not only by physical geographers, but by many botanists and some zoölogists. Thus 'Humid' and 'Arid' become appropriate and suggestive designations for the eastern and western subdivisions of the North American Warm Temperate Subregion. For the lesser regions geographical

¹ This is not only apparent from his papers, but I am informed by him that this was intentionally the case.

names, as 'Hudsonian,' etc., are admirably appropriate when suggestive of some characteristic portion of the region in question. Terms designating grade should, of course, be used with the same strictness as the corresponding terms,—order, family, genus, etc., expressive of rank,—in biology.

Realm is employed as a designation for primary regions, taking the world at large, and Fauna for the ultimate subdivisions. Region, the term selected for divisions of the second rank, has been used by different writers for areas of various grades, but it is proposed to limit its application in a technical sense to the primary divisions of Realms. Below this, in successively descending order, we have Subregions, Provinces, Subprovinces, Districts and Faunæ; faunæ being subdivisions of districts (in cases when it seems desirable to recognize districts), while districts are the primary subdivisions of the subprovinces. In the Arctic Realm the only subdivisions it seems necessary to recognize are faunæ; in the Cold Temperate, possibly both districts and faunæ; in the Warm Temperate, at least so far as North America is concerned, it seems desirable to recognize (1) provinces, (2) subprovinces, (3) districts, and (4) faunæ.

As early as 1878¹ I separated the 'North American Region' into two *Subregions*, namely, a *Cold Temperate Subregion* and a *Warm Temperate Subregion*, as is done in the present paper, using these terms as headings in tables giving the distribution of the genera of North American mammals. Baird's 'Eastern,' 'Middle,' and 'Western' *Provinces* were recognized as "natural regions," with the designation of 'Provinces,' but with the Eastern Province modified so as to restrict it to the Warm Temperate Subregion, and all three reduced in grade to regions of the third rank² instead of the second rank as regarded by Professor Baird.

In 1883 Dr. Packard³ substantially adopted this classification in treating of the faunal regions of North America, with, however, a change of name for the 'Cold Temperate Subregion,' he

¹ Bull. U. S. Geol. and Geogr. Survey (Hayden), IV, 1878, pp. 338-344.

² That is, of the North American Region; really of fourth rank, considered from the basis of the world as a whole.

³ Twelfth Ann. Rep. U. S. Geol. and Geogr. Survey (Hayden), pt. I, 1883, pp. 362-370, and map; the latter republished in the Third Rep. U. S. Entomol. Comm., 1883, map iv.

adopting for it that of 'Boreal Province' — an unfortunate suggestion of my own made later in the paper above cited (l. c., p. 376, where, in some unaccountable way my former division of the 'North Temperate Realm' into 'Subregions' was wholly overlooked!). Dr. Packard, in his otherwise excellent 'Zoö-geographical Map of North America,' failed, however, to recognize the southward extension of the Cold Temperate Subregion along the principal mountain systems of the continent.

Dr. Merriam in 1890¹ again set off the Cold Temperate Subregion, under the name 'Boreal Province,' and mapped in detail its southern prolongations into the mountainous parts of the Warm Temperate. The Warm Temperate Subregion was also recognized as a contrasting region of coördinate rank, under the designation 'Sonoran Province,' while the old 'Eastern,' 'Middle,' and 'Western' Provinces were properly repudiated as having no basis in nature. Particularly is this the case in respect to the Central Province, of which Dr. Merriam observes: "The region almost universally recognized by recent writers as the 'Central Province' is made up of the Great Plains, the Rocky Mountains and the Great Basin. A critical study of the life of the Rocky Mountains has shown it to consist of a southward extension of the Boreal Province, with an admixture of southern forms resulting from an intrusion or overlapping of representatives of the Sonoran Province, some of which, from long residence in the region, have undergone enough modification to be recognized as distinct subspecies or even species. A similar analysis of the Great Plains and Great Basin has shown them to consist of northward extensions of the Sonoran Province, somewhat mixed with the southernmost fauna and flora of the Boreal Province. Thus the whole of the so-called 'Great Central Province' disappears.

"This explains a multitude of facts that are utterly incomprehensible under the commonly-accepted zoölogical divisions of the country. These facts relate particularly to the distribution of species about the northern boundaries of the supposed Central and Pacific Provinces, and to the dilemma we find ourselves in when attempting to account for the origin of so many primary

¹ N. Am. Fauna, No. 3, Sept. 1890, pp. 24-26, and map 5; see also Proc. Biol. Soc. Washington, VII, 1892, pp. 21-40, and accompanying map.

life areas in a country where there are no impassable physical barriers to prevent the diffusion of animals and plants."¹

Dr. Merriam's generalizations respecting the Central Province of authors mark an important advance in the study of North American bio-geography. Taking this region with its original boundaries and significance it is a highly artificial division, embracing within its area very unlike faunal elements. Eliminating from it, however, the broad central arm of the 'Boreal' or Cold Temperate Subregion, which occupies so much of the great central plateau, relieves it of an extraneous element, and reduces it to a more natural and geographically quite different region.

The first discrepancy between Dr. Merriam's classification and my own that requires notice is in respect to the primary divisions of the North American Region, which he first termed 'Provinces'² and later 'Regions,'³ with the prefixes 'Boreal' and 'Sonoran' respectively for the 'Cold Temperate' and 'Warm Temperate' *Subregions* of the present writer. The use of Boreal, however, as shown above, was not an innovation; but the term 'Sonoran' was used in a new and greatly extended sense, the term Sonoran being applied to a region identical in geographical extent with the Warm Temperate,—a designation previously used for the same area,—and hence including the region east of the Mississippi (as well as that west of it), from the Great Lakes and southern New England south to Florida and the Gulf Coast. The terms 'Sonoran' and 'Sonoran Province' were used as early as 1866 by Prof. Cope,⁴ and also later by Cope, Heilprin, and others, for a region of comparatively small extent, consisting of Sonora and adjoining portions of Arizona and New Mexico. In 1887 Heilprin⁵ extended the region to include "the peninsula of Lower California, the State of Sonora in Mexico, New Mexico, Arizona, and parts, not yet absolutely defined, of Nevada, California, Texas, and Florida," and modified its title by calling it the 'Sonoran Transition Region.' The Sonoran Province or Region of these authors is thus not at all the 'Sonoran Region' of Merriam, which is an area of much greater extent and of higher rank.

¹ N. Am. Fauna, No. 3, pp. 22, 23.

² N. Am. Fauna, No. 3, p. 19, 20.

³ Proc. Biol. Soc. Washington, VII, 1892, pp. 22, 26.

⁴ Proc. Acad. Nat. Sci. Phila., 1866, p. 300.

⁵ The Geogr. and Geol. Distrib. of Anim., p. 106.

The term Sonoran, used in this extended sense, seems at least inappropriate if not misleading, as there are few if any strictly 'Sonoran' types represented in that portion of the United States situated to the eastward of the Mississippi River. The more descriptive and appropriate designation of 'Warm Temperate' is therefore preferred for the region in question, since it not only has priority, but is in harmony with the terms Arctic, Cold Temperate, and Tropical, used currently for other coördinate areas of the continent.

Another, and perhaps the only other, important discrepancy between Dr. Merriam and myself is in respect to the primary subdivisions of the Warm Temperate or 'Sonoran' Subregion. Here the difference is in respect to classification, Dr. Merriam dividing the Warm Temperate into two transcontinental divisions which he terms respectively 'Upper' and 'Lower Sonoran'; while according to my best judgment the primary division is in a meridional line into an eastern and a western division, which I have termed respectively Humid and Arid Provinces, borrowing the terms from Dr. Merriam, who has used them in the same geographical sense but not in the same nomenclatural relation, as already shown in preceding pages. As the evidence, pro and con, has already been submitted (see *antea*, pp. 128-131, and Bull. Am. Mus. Nat. Hist., IV, pp. 230-232), it is unnecessary to rediscuss the matter here.

In respect to the subdivisions respectively of the Humid and Arid Provinces, my subprovinces correspond to his secondary divisions of the 'Sonoran' (with slight modifications, as already explained), my Appalachian Subprovince being essentially his 'Humid Upper Sonoran,' my Austroriparian Subprovince his 'Humid Lower Sonoran,' my Campestrian Subprovince his 'Arid Upper Sonoran,' and my Sonoran Subprovince his 'Arid Lower Sonoran.' My division of the Campestrian Subprovince into Districts conforms nearly with Dr. Merriam's division of the same geographical area,¹ and I have adopted for these areas the same descriptive appellations.

Taking Dr. Merriam's latest paper on the faunal areas of North America and accompanying map,² one other point of difference calls for notice, namely, his recognition of a 'Transition

¹ N. Am. Fauna, No. 3, p. 25.

² Proc. Biol. Soc. Wash., VII, pp. 1-64, April, 1892.

Zone,' interposed between and separating the Cold Temperate, or 'Boreal,' from the Warm Temperate, or 'Sonoran' (l. c. pp. 30-33). This is equivalent to what is termed in this paper the Alleghanian Zone, and forms the northern transcontinental belt of the Warm Temperate. This zone was first recognized by Dr. Merriam in the West as the 'Neutral or Pine Zone,'¹ and correlated later with the Alleghanian Fauna of the East, as the 'Neutral or Transition Zone.'

The Alleghanian Zone is beyond question a transition belt, being necessarily so from its geographical position; its affinities, however, are decidedly with the Warm Temperate division of the continent rather than with the Cold Temperate, as the case was first interpreted by Dr. Merriam,² since its northern boundary coincides closely with the northern limit of distribution of a large number of southern genera of both plants and animals, including most of the staple grains and fruits of the Warm Temperate Zone.

As is well known, there is always a belt of neutral territory along the common boundary line of two adjoining areas, varying in breadth with the rank of the two areas; and the present case of the Alleghanian Zone is thus not exceptional. All things considered it therefore seems best to regard it as the northern transcontinental belt of the Warm Temperate, rather than to give it the anomalous position of a minor faunal area interposed between and completely separating two areas of a higher grade.³ Besides, the term 'transition,' for reasons already given, is not a distinctive designation for a faunal area of any grade, although it has been repeatedly used in this way by different writers; its proper function is that of a descriptive term—not a designation to be used in a taxonomic sense.

The various faunal areas recognized in the present paper may be tabulated as follows:—

¹ N. Am. Fauna, No. 3, 1890, p. 11, map 5.

² N. Am. Fauna, No. 3, p. 20, and *ibid.*, No. 5, p. 21.

³ In biology 'aberrant,' 'transition' or intermediate genera are frequently met with, and in some cases it is difficult to refer them to one of the two subfamilies to which they are allied rather than to the other. Yet we feel compelled to refer them to one or the other, or else to make a new subfamily for the aberrant genus, in case it shows sufficient differentiation, rather than to leave it as an isolated genus, with the rank of a genus, to be interposed between two subfamilies, or families, as the case may be.

Tabular Synopsis of the Faunal Areas of North America.

REALMS	{ Arctic. North Temperate. American Tropical.	
REGIONS	{ North American Central American Antillean	{ North Temperate Realm. < American Tropical Realm.
SUBREGIONS	{ Cold Temperate Warm Temperate	= North American Region.
PROVINCES	{ Humid Arid	= Warm Temperate Subregion.
SUBPROVINCES	{ Appalachian Austroriparian Campestrian Sonoran	{ = Humid Province. = Arid Province.
DISTRICTS	{ Great Plains Great Basin Pacific Coast	= Campestrian Subprovince.
FAUNÆ ¹	{ Barren Ground Alaskan-Arctic Aleutian Hudsonian Canadian Sitkan Alleghanian Carolinian Louisianian Floridian Tamaulipan Saint Lucas	{ Arctic. Cold Temperate. Humid Warm Temperate. Tropical.
ZONES	{ Arctic or Hyperborean. Subarctic or Hudsonian. Cold Temperate or Canadian. North Warm Temperate or Alleghanian. Middle Warm Temperate or Carolinian. South Warm Temperate or Louisianian. Subtropical or Floridian.	

¹ Mainly those of Eastern North America only.

NOTES ON THE PLUMAGE OF SOME BIRDS FROM
UPPER SOUTH CAROLINA.¹

BY LEVERETT M. LOOMIS.

IN THE years I have spent in field study of the birds of South Carolina I have incidentally collected specimens illustrating various phases of plumage. This material I have compared at the American Museum of Natural History, and the notes which follow are the result of this comparison or have been suggested by statements current in the literature.

Buteo borealis.—A moulting specimen, July 3, 1879, has worn rectrices that are grayish brown and numerous banded, and new ones (in various stages of development) that are rufous, with conspicuous subterminal bar of black. In an example (♂ juv., Sept. 25, 1884) of the Western form *calurus*, from Arizona, in the collection of the American Museum, there is a rufous tinge on the tail. In some of the lateral feathers it is slight, but in the majority it predominates. The former specimen shows that the transition from the immature to the rufous-colored tail may be effected at one moult, the latter that the transition may be more gradual. It remains to be determined whether this dual manner of assumption of adult plumage is characteristic in both subspecies or whether the more gradual change is peculiar to the one and the abrupt to the other.

An adult female, Dec. 17, 1881, from South Carolina, approaches *calurus*. It is more typical in respect to intensity of color than some examples in the American Museum, from Arizona, labelled *calurus*. It seems preferable, notwithstanding the established fact of southeasterly migration, to regard this specimen as an extreme dark phase of *borealis* rather than a bird of Western birth. It is a safe rule not to admit a subspecies, supposed to be extralimital, into a fauna upon the strength of a single specimen, unless the specimen typically exemplifies all the characters of the subspecies.

The last, like the first specimen noticed, has a broad subterm-

¹ Unless otherwise stated, the particular locality in each instance is Chester County.

inal bar of black on the tail. In another adult female, Dec. 19, 1878, this is wanting, a few isolated spots and faint traces being the only indications of it. It may be questioned whether this subterminal marking is simply individual, or whether it is an indication of immaturity.

Ceryle alcyon. — In a female taken Dec. 13, 1877, the rufous abdominal belt is complete. This is also the case in eleven specimens in the American Museum obtained at various seasons.

Ceophlæus pileatus. — A male, shot Oct. 11, 1886, exhibits a tendency to extension of the red of the head to the broad white stripe on its sides, there being a dash of this color below the eyes and backward.

Antrostomus vociferus. — The absolute necessity of determining the sex by dissection is strikingly exemplified in a female of this species (April 14, 1888), which has the throat bar chiefly pure white. It is much narrower than is usual in the male. The other markings are not exceptional. There is a nearly similar specimen in the American Museum collection from New York, procured May 31, 1883.

Calcarius pictus. — A female, Feb. 9, 1889, has the lesser wing-coverts deep black with a broad terminal bar of pure white.

Guiraca cærulea. — Wilson in his description of this species says, "The female is of a dark drab color, tinged with blue, and considerably lightest below." More recent writers appear to have overlooked that the female in high plumage exhibits considerable blue coloration, attesting that Wilson even at this day may be consulted with profit in matters relating purely to the technics of ornithology. The following descriptions of two specimens illustrate the higher colors assumed by the female.

♀ *ad.* (Aug. 25, 1885). Crown, rump, jugulum, fore breast, malar region, and lesser coverts, blue; occiput, auriculars, throat and neck all around, scapulars, edge of wing, upper tail-coverts, outer edges of rectrices, except lateral pair, strongly tinged with blue. This specimen is in worn plumage with three rectrices in process of renewal.

♀ *ad.* (May 7, 1891). Top of head, fore part of cervix, throat, jugulum, malar region, rump, lesser coverts, and edge of wing, blue, obscured by brownish tips to the feathers, particu-

larly from the occiput backward; rectrices, except outer pair, edged exteriorly with blue, and alula, primaries, and primary coverts with bluish; upper tail-coverts and auriculars tinged with blue, the former tipped with whitish; sub-apical portions of feathers on breast and sides of neck decidedly bluish; middle and greater coverts tipped with ferruginous.

In brief, the blue in these two specimens chiefly prevails about the head, jugulum, rump, and lesser wing-coverts. If the tips of the feathers were worn off in the second specimen as in the first, the concealed blue would be extensively unveiled and a richer attire would result.

I am constrained to believe that this blue phase represents the adult plumage of the female, and that the plain one generally described in the books is an immature stage, for every season highly colored females have been obtained in numbers fully equal to the adult males of highest feather. Also, plain females and those with but slight traces of blue have occurred in proportion to the more soberly dressed males. Further proof that this high coloration is indicative of maturity is found in the fact that the hornotines I have taken in the fall moult have displayed no sign of it. Failure of sexual vitality has been advanced as an explanation in somewhat similar cases. That such physical change is not the cause in the present instance has repeatedly been proven by dissection and by capture of mated birds. A tendency to assumption of the more showy costume of the male has been observed in *Passerina cyanea*, *Piranga rubra*, and *Dendroica caerulescens*. It is highly probable that parallels are to be found in many if not all species in which the male and female differ widely in color. It is a question whether the variation in these cases may not be individual. Special investigation in each species alone will decide the matter.

An immature male with testes partially enlarged, taken May 18, 1891, has the blue chiefly confined to the sides of the head. In a series, the two females described above would far more readily be picked out as immature males. In the spring of 1890 males in full dress were secured from the outset. The following year only those in brown and blue plumage were obtained up to May 19, the last day search was made. Where the deeper colored plumage was concealed by brown tips to

the feathers, the juvenile appearance of the birds of the second season appeared to be due to a retarding of the process of abrasion, which wearing away of the terminal portions of the feathers is manifest in this species from its first arrival in this locality.

Piranga erythromelas. — There is a marking on the under surface of the wing in the female and in the male in green livery which seems to have escaped general notice, but which renders both distinguishable at a glance from the female or young male of *P. rubra*. It extends from the carpal joint to the exposed shaft of the outer primary, and is about an inch in length and an eighth of an inch in width and olive brown in color. It corresponds to a similar black marking in the adult spring male. In all examples of *P. rubra* I have examined the region of the under wing-coverts is uniform yellow in the female and red in the adult male.

Piranga rubra. — The following description is of a female, with ovary of a breeding bird, taken June 2, 1879. Prevailing color above brownish gray, with touches of olive-yellowish; under surface cream-color, washed with Naples yellow, with a patch of chrome yellow on breast. Three males and a female of subspecies *cooperi* in the American Museum resemble this specimen in their faded appearance.

Helminthophila chrysoptera. — A female from Cæsar's Head, June 16, 1891, shows an indication of albinism in the continuation of the white of the malar region over more than half of the throat and chin.

Helminthophila celata. — In a fall male and a spring female the eyelids are edged with whitish, forming an orbital ring which was very distinct when the birds were in the flesh.

Dendroica cærulescens. — The black feathers of the throat and chin are without white tips in a male obtained Oct. 2, 1888, and the scapulars and interscapulars are distinctly spotted with black, and unwashed with olive green. The whole appearance of the specimen is that of a spring male in high feather. The exterior edges of several of the outer primaries, near their extremities, are, also, whitish, constituting a rather distinct area when the wing is closed. In another October example the dorsal streaks are so heavy and numerous as to present the ap-

pearance of a black patch, nearly as conspicuous as the olive green one in *Compsothlypis americana*. In still another, the crown is thickly marked with black shaft lines.

Dendroica castanea.—In a male, May 5, 1888, the buff on the sides of the neck is continued into a broad cervical collar, streaked with dusky. Another May specimen, also a male, shows indications of a similar collar.

Geothlypis formosa.—Breeding females of this species from Mt. Pinnacle and Cæsar's Head are duller colored on an average than the males. The black, especially, is less intense, and considerably restricted. In some it is nearly wanting on the crown. The brightest females and the dingiest males, however, are indistinguishable.

FURTHER NOTES ON THE EVENING GROSBEEK.

BY AMOS W. BUTLER.

In addition to the records of the range of the Evening Grosbeak (*Coccothraustes vespertinus*), given in 'The Auk' for July, 1892, I am enabled, through the kindness of several friends, to offer some additional notes.

In the winter of 1889-90 Evening Grosbeaks were tolerably common in the vicinity of Ft. Wayne, Indiana. Mr. C. A. Stockbridge, in addition to the two reported Feb. 15, 1890, noted eleven Feb. 16, one March 22, one April 9, and one April 12.

Mr. C. E. Aiken of Salt Lake City, Utah, informs me that a large number of specimens were obtained near Whiting Station, Indiana, in the winter of 1886-87 by Mr. R. A. Turtle of Chicago. To some few of these I have doubtless referred before.

Prof. F. Cramer, Lawrence University, Appleton, Wis., under date of March 14, 1891, says: "Two weeks ago a flock of five Evening Grosbeaks spent a few minutes on a tree in our back yard. They were quietly eating the little crab apples that had not fallen off the tree. Feb. 7 Professor Lummis saw a flock of ten eating the fruit of a climbing bitter-sweet near his house. They did not stay long."

Mr. T. McIlwraith, Hamilton, Ontario, very kindly sent me an account of his observations concerning these birds in the winter of 1889-90. He says: "The first flock was noticed on Dec. 22, 1889. I soon found their haunts, which I visited almost daily till the end of January when the eastern migration ceased. Passing flocks were again seen in March going rapidly westward, but the numbers were less, and they made no stay. In Canada they seemed to travel on a straight, narrow line from Windsor to Quebec, north or south of which they were not observed, till they reached the east end of Lake Ontario, when they scattered south through New York. Near Hamilton they frequented the north shore of the lake, where they fed on the berries of the red cedar; they were also noticed taking the seeds from such apples as remained on the trees at that season."

Mr. L. W. Watkins, Manchester, Michigan, has been very obliging in supplying me with the following notes: "Late in the fall of 1889 Washtenaw and other counties were visited by the Evening Grosbeak. They came in large flocks, sometimes two hundred or more. These flocks were scattered very generally over the country, about one flock to every six square miles. They frequented gardens, orchards, and dooryards. Towards dusk they all disappeared, but at early dawn they were back again in the apple orchards where they fed upon the apple seeds, cracking them open as do the tame canaries their hemp seeds. There were many frozen apples upon the trees and on the ground. These they pulled to pieces, rejecting all but the seeds. When the supply of fruit seeds gave out they ate maple seeds, but, so far as I have observed, they ate evergreen cone seeds only as a last resort. Their unwary nature, and high, bell-toned, garrulous chirrup attracted the attention of even the most unobserving. I resolved to try to capture some, thinking they might breed in confinement. In our yard was a crab-apple tree. The ground beneath it was covered with the little fruits. When the Grosbeaks had exhausted the supply of food in the orchard they came to this tree. When frightened, while upon the ground, they invariably flew straight up among the branches of that tree instead of flying off to some other. I arranged an old pigeon net among the branches to try to catch some. When coming to feed they always alighted in a body upon the ground, and did not alight

first upon the tree. I was only enabled to capture one, — a fine male, — and I could never repeat the netting. The captive was put into a large cage and he soon became accustomed to the new conditions. By using the captive as a stool pigeon, with the aid of some hemp seed, I was enabled to induce two males to enter the house. Suddenly I closed the entrance way, when they were easily caught. Although I often tried, I never could get a female to approach the cage. They seemed much more timid than the males. The three captives were very cross to each other, the bully being nearly as persistent in his attacks upon his companions as is the cock in the farmyard upon his rivals. Their food consisted of sunflower seeds, mixed canary seeds and apple seeds. When very hungry they would eat oats, but very reluctantly. Corn, wheat, barley, the pulp of fruit, and garden vegetables, they would not touch. Diptera, hymenoptera, lepidoptera and coleoptera were offered them and were refused. Angle worms and spiders were likewise uneaten. When caged, their note was changed from the usual chirrup to a shrill whistle or shriek, and, at times, they closely mimicked a young chicken when lost. They never sang, but occasionally chattered to each other with much animation. They also made sounds closely approaching a low warble. They always slept, at night, with the head under one wing. I was very anxious to know how they would stand the hot weather, but 90° F., in the shade, found them as unconcerned as in winter. Neither did they show any restlessness in spring, when their mates were leaving. A remarkable change was manifest after their first moult. The olivaceous and yellowish tints, in the new feathers, were turned to slaty drab and brownish green, respectively, though the pure yellow on forehead and scapulars remained as before, as also did the black and white portions. Thus they were changed from bright, attractive birds to very oddly and conspicuously trimmed birds of plain — rather dirty — color. Nor did this color change with the age of the feathers. The next summer showed the same shades. In the fall of 1891, after living in confinement two years, one after another died, not from neglect, but they seemed to pine away and die from the effects of captivity."

THE CHIONIDIDÆ.

(*A Review of the Opinions on the Systematic Position of the Family.*)

BY R. W. SHUFELDT.

EVER since the time that I first examined a skeleton of *Chionis minor* I have held that that species is related, in so far as its osteology is concerned, to the Plovers, and in July, 1891, I published in the 'Journal of Anatomy and Physiology' (London) an illustrated memoir upon this remarkable type, wherein I said that "*Chionis minor* probably constitutes one of the links among the Plovers and the Gulls, standing close up to the former and having its nearest living allies in *Hematopus* and such forms as *Glareola*. Recognizing this as we do, we cannot ignore, on the other hand, the impress it has at least received upon its skeleton from the columbo-gallinaceous group, and the Bustards, through the Plovers, seem to offer us a partial clue here, or missing links in the line through *Hemipodius*, or perhaps, too, in some yet unknown way, through *Syrrhaptes*, the other connecting forms having passed away, and left us only such conjectures as these to offer upon the position of *Chionis* in the system" (p. 524). Since the above was printed I have again re-examined my material and re-read the literature on the subject. My views remain practically unaltered.

The morphologist need not especially take into consideration the writings of naturalists upon the genus *Chionis* prior to 1836. In that year, however, M. De Blainville¹ anatomically examined the best part of a skeleton of a specimen of *C. alba*, and decided that *Chionis* was most nearly related to *Hematopus*. My figures and descriptions of the skeleton of *C. minor* in the 'Journal of Anatomy' seemed to me to lend substantial support to the opinion of that learned researcher, and there is no question but that he was pre-eminently correct about his views of the sternum.

¹ Blainville, M. H. D. De—Mémoire sur la place que doit occuper dans le système ornithologique le genre *Chionis* ou Bec-en-fourreau. Ann. Sci. Nat. VI, 1836, p. 97.

Nothing worthy of special note upon the structure of the bird appeared after De Blainville's contribution until Mr. Eyton published some observations twenty-two years afterwards,¹ and he was inclined to place the form near *Glareola*. Eleven years later Dr. Cunningham examined the larynx and parts of the digestive apparatus of a specimen of *Chionis alba*, and he remarked that "the legs present a decided resemblance to *Hæmatopus*, and the sternal characteristics are similar."² Professor Newton who has both described and figured the egg of *Chionis minor* has said that it "confirms by its appearance the systematic position of the form [*C. minor*] shown by osteology, its affinity, namely, to the Plovers."³ The literature of the subject is next materially enhanced by the appearance of the memoir by Doctors Kidder and Coues,⁴ and those distinguished writers distinctly dissent from the views of De Blainville and all foregoing authors on the subject, and are lead to believe that "*Chionis* stands between grallatorial and natatorial birds, retaining slight but perfectly distinct traces of several other types of structure" (p. 109); and further: "We thus find in *Chionis* a connecting link, closing the narrow gap between the Plovers and Gulls of the present day. In our opinion, this group represents the survivors of an ancestral type from which both Gulls and Plovers have descended. And this opinion is strongly supported by the geographical isolation of its habitat, affording but few conditions favorable to variation" (p. 114). They propose the group Chionomorphæ to contain the two known species *C. minor* and *C. alba*, the "Chionomorphs" then "constituting exactly the heretofore unrecognized link between the Charadrimorphs and Cecomorphs, nearer the latter than the former, and still nearer the common ancestral stock of both." They were further of the opinion that *C. minor* is "undoubtedly nearest to the ancestral type" and therefore called it *Chionarchus minor*. Messrs. Sclater and Salvin in their 'Nomenclator' include the Chionididæ in their

¹ Eyton, T. C.—Note on the skeleton of the Sheathbill (*Chionis alba*). Proc. Zool. Soc. XXVI, 1858, pp. 99, 100.

² Cunningham, R. O.—On *Chionis alba*. Jour. Anat. and Phys., Nov., 1869, pp. 87-89.

³ Newton, Alfred—Proc. Zool. Soc., Jan. 17, 1871, p. 57, pl. iv, fig. 7.

⁴ Kidder, J. H., and Coues, E.—Bull. U. S. Nat. Mus., No. 3, 1876, pp. 85-116.

group 'Limicolæ,' which leads us to infer that they believed it to be most nearly related to the Plovers.¹ In 1880 Mr. Sclater still retained the 'Chionididæ' in the Limicolæ, placing the family between the Charadriidæ and the Thinocoridæ.² Garrod, who was always prone to lay too great stress upon single characters, sustained Kidder and Coues in their opinion upon the affinities of *Chionis*, and believed them to be chiefly larine. He adds, nevertheless, "that the genus deserves to be located in a separate division, however, as Dr. Coues suggests, I cannot agree," and further "that Dr. Coues's account of the myology of *Chionis minor* is incomplete as far as the varying muscles are concerned." Strange to say, Garrod found, in studying the muscles, the following, directly militating against his expressed opinion—namely, the Laridæ all lack the accessory femoro-caudal, while certain of the Charadriidæ as well as both *Chionis minor* and *C. alba* possess it. Every one of these families possesses the ambiens.³ Now the principal fault to be found in the work of Doctors Kidder and Coues, is that the major part of their dissections were *not made comparative*. As Garrod noticed, their dissections of the muscles is extremely deficient. Their studies of the 'viscera' of *Chionis* are even more so, and, finally, there is barely any evidence whatever in their study of the skeleton of *C. minor* that it was critically compared with the skeletons of such genera as *Larus*, *Hæmatopus*, *Alca*, or a species of the *Gallinæ*. Professor Parker who was always great in his comparisons of the details in the skeletons of many kinds of birds from every conceivable group, and who possessed clear taxonomical ideas in his generalizations, as a rule, believed, when he gave his 'scheme' of the relationships of *Pluvialis*, that the Plovers through *Hæmatopus* and *Chionis* were connected with the Tubinares on the one hand, and through *Glareola* and *Sterna* were connected with the Laridæ upon the other. That Parker spoke of *Chionis* as a "thoroughly *marine* Plover," and not as a thoroughly *terrestrial* Gull, is good evidence upon what he thought about the

¹ Sclater, P. L., and Salvin, O.—Nomenclator Avium Neotropicalum, p. 142. 1873.

² Sclater, P. L.—Remarks on the Present State of the Systema Avium. Ibis (4 ser.), IV, 1880, p. 340.

³ Garrod, A. H.—Coll. Sci. Mem. pp. 221, 222, 419. 1881.

affinities of the Sheathbill.¹ It is worthy of mention, too, that in 1882 Dr. Reichenow² placed *Chionis* near *Hæmatopus*, and Burmeister was of the same opinion.

Other authors, both early and recent, have held diverse opinions as to the affinities of the *Chionididæ*, and we still stand in need of a complete study of the entire structure of *Chionis*. Thus, for example, Forbes placed the Sheathbill between *Dromas* and *Thinocorus*,³ and Gray between the *Thinocoridæ* and the *Hæmatopodidæ*,⁴ while some even, as we are aware, referred the family to the Fowls and others to the Pigeons, Hartlaub being a representative of the former and Swainson of the latter class of writers, but as their views are not supported by a knowledge of the structure of the Sheathbills, we only mention their names here in order to show what different opinions naturalists will entertain when those opinions are based upon the external appearance of things.

Forbes has not been the only classifier to place *Chionis* near the *Thinocorythidæ*, for such a view is quite generally held; Eyton had that idea, and Selater, already cited above, and Carus, and Sundevall,⁵ and Wallace,⁶ Lilljeborg,⁷ and Fitzinger,⁸ and of such an opinion Newton has said that "The little group of very curious birds, having no English name, of the genera *Thinocorys* and *Attagis*, which are peculiar to certain localities in South America and its islands, are by some systematists placed in the family *Chionididæ* and by others in a distinct family *Thinocoridæ* (more correctly *Thinocorythidæ*. They are undoubtedly limi-

¹ Parker, W. K.—On the Osteology of Gallinaceous Birds and Tinamous. Trans. Zool. Soc. Lond. 1866, V, 5, pp. 206 and 236.

² Reichenow, A.—Die Vögel der Zoologischen Gärten. I, II. Leipzig, 1882–1884.

³ Forbes, W. A.—Collected Scientific Papers. 1885, p. 226.

⁴ Gray, G. R.—Handlist of Genera and Species of Birds, I, II. 1869–1871.

⁵ Sundevall, C. J.—Methodi Naturalis Avium Disponendarum Tentamen. Stockholm, 1872.

⁶ Wallace, A. R.—Attempts at a Natural Arrangement of Birds. Ann. Nat. Hist. (2d ser.), XVIII, 1856, p. 193.

⁷ Lilljeborg, W.—Outlines of a Systematic Review of the Class Birds. Proc. Zool. Soc., 1866, p. 5.

⁸ Fitzinger, L. J.—Ueber des System und die Charakteristik der natürlichen Familien der Vögel. Sitz. K. Akad. d. Wiss. Math.-Nat. Cl. XXI, p. 277 et seq. Vienna, 1856–65.

coline, though having much the aspect of Sand Grouse, but their precise position and rank remain at present uncertain."¹ (Cf. Garrod (*ut supra*) and Professor Parker (Trans. Zool. Soc. Lond. X, pp. 301 et seq.) To the number of those who correctly saw that the hæmatopine characters in *Chionis* predominated over its larine ones, we must not forget to add the worthy name of De Blainville's pupil L'Herminier,² who also saw something of the anatomy of the Sheathbill, and enough to convince him that the bird was more Oystercatcher than it was Gull; and no less distinguished a naturalist than M. Alph. Milne-Edwards³ is of the same opinion. Support again came to this view in 1885 when Dr. Leonhard Stejneger published his scheme of classification of birds in the 'Standard Natural History' (Boston: Cassino & Co.). This writer divides his 'Order VII, the Grallæ' into five superfamilies, of which the first is the Chionoideæ, containing the two families (1) Chionidæ, and (2) Thinocoridæ. This superfamily is followed by the Scolopacoidæ, containing such families as the Glareolidæ, Dromadidæ, Charadriidæ and others. The Laridæ and their allies are in another and different order, viz., the Cecomorphæ, which practically agrees with Huxley's group of the same name. A few years after the appearance of this work there appeared the two sumptuous volumes on the structure and classification of the class Aves by Fürbringer,⁴ and the following from his scheme gives his views upon the position of the Chionididæ:—

¹ Newton, A.—Art. 'Sheathbill.' Encycl. Brit. 9th Ed. Vol. XXI, p. 782. Newton in this article again invites attention to the unfortunate inaccuracies in the memoir of Doctors Kidder and Coues, and adds "The opinions of De Blainville and Dr. Reichenow are borne out by the observations of Mr. Eaton (Philos. Trans. CLXVIII, pp. 103-105), and no one knowing the habits of an Oystercatcher can read his remarks without seeing how nearly related the two forms are."

² L'Herminier, F. J.—Recherches sur l'appareil sternal des oiseaux, considéré sous le double rapport de l'ostéologie et de la myologie, etc. Mem. Soc. Linnéenne VI, p. 1. Paris, 1827—2d ed. Paris, 1828.

³ Ann. Sc. Naturelles, ser. 6, XIII, art. 4, p. 247.

⁴ Fürbringer, Max.—Untersuchungen zur Morphologie und Systematik der Vögel. Amsterdam and Jena, 1888, 30 plates.

O. CHARADRIORNITHES. Ægialornithes. S. O. Charadriiformes.	G. s. lat. Laro-Li- micolæ	{	G. s. Charadrii	{	F. Charadriidæ.
					F. s. str. Glareolidæ.
					F. s. str. Dromadidæ.
					F. Chionididæ.
					F. Laridæ.
					F. Alcidæ.
					F. Thinocoridæ.
					F. Parridæ.
			G. Otides	{	F. Ædicnemidæ.
					F. Otididæ.

It would seem that Professor Fürbringer saw more Gull than Plover in the Sheathbills, and had underestimated the significance of the characters presented on their part, inasmuch as he has only awarded them family rank.

The following year Cope¹ published his 'Synopsis of the Families of Vertebrata,' and in his arrangement of Aves sets forth the position of the Sheathbills as follows:—

SUPERORDER EURHIPIDURÆ.	{	ORDER	{	SUBORDER	{	FAMILIES
		Euornithes		Grallæ		Chionidæ.
						Thinocoridæ.
						Glareolidæ.
						Dromadidæ.
						Charadriidæ.
						Otididæ.
						Eurypygiidæ.
						Rhinocetidæ.
						Cariamidæ.
						Psophiidæ.
						Gruidæ.
Rallidæ.						

The Laridæ and their supposed allies he places in another suborder of the Euornithes, viz., the Cecomorphæ.

It will be seen that Cope's suborder Grallæ with its twelve families nearly corresponds to Stejneger's order Grallæ with its five superfamilies divided into its seventeen families. Cope here revived the opinions of those who believed that *Chionis* stood most nearly related to the 'Thinocoridæ,' and yet showing too that it was more Plover than Gull.

¹ Cope, E. D.—Amer. Nat. Vol. XXIII, No. 274. Oct. 1889, pp. 849-877.

In 1891 the present writer's memoir¹ on *Chionis minor* appeared, which has been referred to at the beginning of this article, and in the same year there was published the very admirable contribution to the classification of birds by Dr. Sharpe of the British Museum, one of the most useful papers now in the hands of systematic ornithologists.² With the exception of the present writer's article from the 'Journal of Anatomy,' Doctor Sharpe had before him at the time of his writing his 'Review,' all the schemes of classification of Aves mentioned in this paper, and no doubt many others not herein noticed; and in it he sets forth his own most able views upon the taxonomy of the class. The Sheathbills are thus placed:—

ORDER XVIII	SUBORDERS	FAMILIES
CHARADRIIFORMES	XXII. Dromades	Dromadidæ.
	XXIII. Chionides	Chionididæ.
	XXIV. Attagides	{ Attagidæ.
		{ Thinocoridæ.
	XXV. Charadrii	{ Hæmatopodidæ.
		{ Charadriidæ.
		{ Scolopacidæ.
	XXVI. Glareolæ	
	XXVII. Cursorii	
	XXVIII. Parræ	
	XXIX. Œdicnemi	
	XXX. Otides	

Further Dr. Sharpe places the Gulls in his Order XVII,—the Lariformes, containing the suborder Lari, and the two families Stercorariidæ and Laridæ, the latter containing the three sub-families Larinæ, Sterninæ and Rhynchopinæ.

Previous to having seen Dr. Sharpe's classification the present writer had the following in manuscript to be used in his forthcoming work upon the osteology of birds.

¹ Shufeldt, R. W.—Contributions to the Comparative Osteology of Arctic and Sub-arctic Water-Birds, Part IX. Jour. Anat. and Phys. Vol. XXV, n. s. Vol. V, pt. IV, Art. V, Plates XI, XII, London, July, 1891, pp. 509-525. The entire part is devoted to the osteology of *C. minor*, and several figures are given of its skull, other figures of the bones of the skeleton having appeared in earlier parts of this series of memoirs.

² Sharpe, R. Bowdler.—A Review of Recent Attempts to Classify Birds; An Address delivered before the 2nd Intern. Ornith. Cong. at Budapest, May, 1891. Budapest, 1891.

SUBORDER	FAMILY	GENERA	SPECIES
CHIONIDES	{ Chionididæ	{ Chionarchus	{ C. minor.
		{ Chionis	{ C. alba.

Such a suborder would probably stand between my suborder Longipennes and the suborder Limicolæ, and there probably would be added to the Chionididæ, the three other families Dromadidæ, Attagidæ, and Thinocorythidæ. But with what I know of the osteology of *Chionis minor* and of *Hæmatopus*, and not having examined the entire structure of any of the three families first named, such a proposal must be considered wholly provisional. A knowledge of the entire morphology of all these forms is something very much to be desired.

OUR SCOTERS.

BY G. TRUMBULL.

IN an article under the above title printed in 'The Auk' of April, 1892, I called attention to numerous errors which had appeared concerning our representatives of the genus *Oidemia*. It was my intention at the time to continue the list of such errors in this second (and in a third) article, but I abandon the idea. Such a continuance would occupy altogether too much space. I give the facts which I have ascertained, with only occasional reference to the failures of former accounts.

Though difficult to conceive how some of the mistakes ever crept into print, it is easy to imagine how others occurred, viz., by the absence of fresh specimens; by compiling, with phraseologic variation, from earlier accounts of more or less credibility; by studying faulty pictures; by mistaking immaturity for maturity; by unhappy inferences; and by a desire, latent or active in us all, to appear at least a little wiser, a little more experienced than we really are.

As such common fowl as these have been so much and so long misrepresented, is it not reasonable to infer that numerous other species have been similarly treated, that there is a great deal of work for the reviser? Would it not be better for ornithologists to go back over the old road, before continuing their investigation of pastures new? The science has grown and will continue to grow chiefly from the examination of dried skins. This, though unfortunate, is practically unavoidable; but is it well that the results of such study should be confounded, as they commonly are, with facts obtained from the living creatures, or from their bodies intact as they lived? One is the study of birds, the other of their fleshless, discolored and distorted remains.

While noting the colors of the bills and feet, I have used — though I have not in every case adopted its terminology — Mr. Ridgway's 'Nomenclature of Colors.' Though the process by which his examples are printed has in many cases produced unhappy results, the volume is nevertheless a most useful medium of communication between writers and readers. No matter how familiar one may be with color and color terms, it is highly important, absolutely essential, to have at hand some such labeled series of tints for immediate comparison and future reference.

Before beginning with *deglandi* I must add to my former account of *americana* (Auk, Vol. IX, pp. 153-155), as I have secured a specimen the feet and bill of which are different from any I had seen prior to that writing.

Oidemia americana.

*Young male.*¹ Plumage — compared with previously described phases — similar to that of "young male in autumn," but lower surface of body whiter, or about as in "young female in spring," with the exception of being less positively spotted. Shape of bill about as in female, but beginning of 'hump' slightly indicated, viz., upper half of maxilla at base broader than in earlier youth: pushed outward at sides noticeably, the culmen, however, remaining as before. Color of bill black, paler in part, changing here and there to olive yellow or yellowish olive, the inside of the nostrils brighter and more yellow. Feet: outer side of tarsus and

¹ Killed Oct. 16, 1892.

outer side of outer toe dull dusky green; inner side of tarsus, both sides of inner and middle toes and inner side of outer and hind toes dark olive, changing to wax yellow; blackish shading at joints and elsewhere; the outer side of the hind toe almost uniformly blackish;¹ webs solidly black.

I am not sure just how long it takes for either of our Scoters to mature, and I will not hazard a guess. Features that we regard as indicative of perfection, may in reality be marks of decline. I feel pretty sure, however, that those drakes (of *deglandi*, the species now in hand) which have the brightest beaks, the most fully opened nostrils, the most cleanly white speculums, the whitest eyes surrounded by the whitest edgings and the largest eye-patches, represent very nearly or quite the fulness of maturity. And I am strongly inclined to believe that after the male and female have once reached maturity, there is little or no seasonal change: that when, for example, the male's plumage has become uniformly black, it remains black evermore; that the perfected colors of the bill and feet are fast colors.

Though we can determine very satisfactorily the comparative ages of specimens, by taking all parts into consideration, the size, as an indicator, is of little value. Several of the larger dimensions which I have noted were taken from birds not fully mature, while some of the smaller measurements are from undoubted adults.

In my former article I referred to two accounts which represent the bill of the *deglandi* drake as red, and simply red,—with the exception of the black portion. I could not imagine at the time how the error occurred. I have since discovered that the purple and orange, and even the white, of nearly mature males, sometimes change within three or four days after death, to an almost uniform purplish red. The descriptions referred to were doubtless taken from such stale specimens. I am careful to say “nearly mature” males, for in such birds only have I observed this change. The fully perfected colors seem to be at least a little more permanent.

¹ The term hind toe in my description of this and the other Scoters is intended to stand (when not otherwise explained) for both the toe itself and its broad membranous flap.

Oidemia deglandi.

Frontal feathering—in most cases—reaching farther forward than the loreal feathering. Sometimes the two extensions are equal, and sometimes (I have only observed it in the case of two young females) the loreal feathering is advanced the merest trifle farther than the frontal. The frontal feathering generally terminates (sometimes acutely, sometimes obtusely) nearly on a line with the posterior edge of the nostril, sometimes reaching beyond, sometimes falling short.¹

Speculum, composed of secondaries and ends of greater coverts, white. In immature birds the black (of the male) or brown (of the female) infringes a little at either end of the snowy area, showing also on the tips of the greater coverts, and narrowly at the ends of the secondaries; but in all the plumages of both the sexes this speculum is very conspicuously large and white. Its dimensions, while the wing is fully spread, are about as follows: length 5.50 to 6.50 inches; width at one end (by the primaries) 2.75, at the other end (by tertiaries) 1.75 to 2.00.

Under surface of wing: a mixture, varying considerably according to age: in the male, from brown, gray and white (young), to black, brown, gray and white (adult); in the female, brown, gray and white.

Eyes: those of all the females, and of the young males designated by letters A, B and C, deep brown.

Feet: outer and inner sides differing about as follows: in adult male, outer side of tarsus and outer side of outer toe one color; inner side of tarsus, inner side of all four toes and outer side of inner toe another color; both colors showing on outer side of middle toe. In nearly adult male: outer side of middle toe showing only outer color of tarsus; this color also showing more or less on outer side of inner toe. Though there are similar variations in the younger males and in the females, they are too faintly marked for comment. These colors of the feet are always, in both sexes, old and young, more or less broadly obscured at joints and elsewhere by black or blackish shading; the outer side of the hind toe (or outer side of its flap) almost or quite uniformly black or blackish. Webs uniform black. In the adult male the black of webs and shading of feet, inky black; in the female and young male, less intense or dull black.

Dimensions.—Male: length 21.00–22.75 inches; extent 37.25–41.50; wing 10.88–12.12. Female: length 19.62–20.75; extent 35.88–37.88; wing 10.62–11.12.

¹ Former accounts are not wholly in accord about these extensions. I copy some of the characters attributed to the sub-genus *Melanitta* (or *Melanetta*) in which this species is placed. One authority says: "Feathers of side of bill extending obliquely forward from the angle of the mouth as far as those above." On another page of the work cited we read that the feathering extends "nearly as far forward on the side of the bill as above." Another and later author says: "Feathering of head advancing much farther forward on lores than on forehead"; but he gives us a drawing of the bill in which the frontal feathers are considerably in advance of the loreal.

Weight. — Male: three pounds eight ounces to four pounds nine ounces.
Female: two pounds twelve ounces to three pounds seven ounces.
(I have measured and weighed nearly a hundred specimens.)

ADULT MALE.

Plumage black, inclining a little to brown along the upper part of the sides¹; a pure white patch below and behind the eye, beginning at front edge of eye and sweeping backward with an upward curve; the eye also completely edged with this white (see fig. 9); upper portions of plumage showing a faint iridescence which tends to green and plum color, the latter tint confined chiefly to the head and neck. Iris white. Bill (figs. 9 and 12): upper mandible immediately at base black, this black spreading forward over the knob and continued along the edge, sometimes as far as the nail, and sometimes disappearing brokenly before reaching it; sides pinkish purple or wine purple,² changed to orange next to the basal black; the nail reddish orange; from nail to knob white, the middle of the bill, in other words, being broadly white from the nail to the black between the nostrils; lower mandible with a patch of reddish orange at the end, including the nail, and back of this color white, the white meeting irregularly with basal black, which is extended in a somewhat varying degree toward the gonys. Feet: outer side wine purple (of a rather light shade and sometimes tending a little toward magenta); inner side coral red or orange-vermilion.³

ADULT FEMALE.⁴

Plumage chiefly dark brown, deepening on upper portions here and there to blackish brown, the brown of the lower surface of the body somewhat lighter and nearly uniform; side of head and the throat streakily and minutely flecked with dull whitish, most noticeably perhaps on the front of the lores, but nowhere forming a 'spot' or 'patch'; most of the neck uniformly brown; the feathers of jugulum, front of neck, scapular region, and sides of body, edged at their ends with

¹ Though I have long believed that this brown wholly disappears, I have not yet found a specimen that did not show some of it. It is completely hidden when the wings are closed.

I have shot none of these adults in June and July, but in all the other months I have found them similar in appearance to those used in this description.

² This color would be better matched if some of the "heliotrope purple" (see Ridgway's plate VIII) were mixed with the "wine purple."

³ I note the omission of a word from former description of these feet ('The Auk,' April, 1892, p. 157). For "side of tarsus and toes" read "outer side of tarsus and toes."

⁴ Described from specimens killed Jan. 19 and April 22.

drab-gray. Bill (fig. 4): upper mandible grayish black, the nail striped lengthwise black and brownish yellow; a somewhat spotty and whitish mixture between nail and nostrils; a well defined and showy patch of deep rose pink or light geranium pink on the side (position of patch shown by fig. 7); lower mandible black, more or less whitish or light gray about the gonys, the nail like its fellow above. Feet: outer side vinaceous, greatly obscured by the black shading; inner side vinaceous rufous.

IMMATURE FEMALES.

A.¹ Almost uniformly blackish brown, the ends of the feathers a trifle lighter than other portions, but not noticeably so; the nape and upper part of head brownish black; an imperfect auricular patch formed by streaky flecks of white; a few scattering flecks of white on the breast. Bill (fig. 2) almost wholly grayish black, but lighter or gray in part, not the least suggestion of the adult female's pink patch; the shape of the bill also very different. Feet: outer side chocolate, inner side as in adult female.

B.² Differing from first young female as follows: somewhat lighter, less uniformly dark, the light ends of the feathers a little more pronounced, the front and side of the head flecked with brownish white, these flecks distributed scatteringly, not accumulate in auricular region, most numerous immediately about the bill.

C.³ Plumage nearly as in maturity, but having a few flecks of white on the breast, and the light flecks of the head whiter and tending to blotchy accumulation here and there, particularly on the cheeks. Bill (fig. 3): color about as in females A and B; frontal feathering terminating as in the adult, or more acutely than in the younger birds. Color of feet not noted.

IMMATURE MALES.

A.⁴ Similar to young female A, but lower surface of body somewhat lighter and grayish—in some specimens grayish brown, in others brownish gray—and with the white flecking of the head forming a positive auricular patch; there is also a faint, imperfectly defined loreal spot or patch, sometimes pale grayish brown, sometimes more whitish. Upon closer inspection the loreal marking is dull white, dotted with brown, the whole shading softly into the uniform brown about it. Bill (fig. 1) deep

¹ Described from specimens killed Oct. 21 and 22.

² Described from specimens killed Feb. 18 and 19.

³ Described from specimens killed April 24.

⁴ Described from specimens killed Oct. 17 and 21.

gray with black shading, the gray of the sides having a faint lavender cast. Feet similar to those of young females A and B, but lighter.

The descriptions of female A and male A represent the young during their first autumn, and this young male corresponds probably about as well with Herbert's '*bimaculata*' as any bird we shall ever find.

B.¹ Plumage very similar to adult female, with following exceptions: somewhat lighter on front of forehead and lores; lower surface of body decidedly whitish, — broadly so from jugulum to legs, — or white faintly spotted with brownish gray, shading to a more uniform, more brownish and deeper tint toward the tail; the rectrices with buff or pale brown tips. Bill: in shape about as in younger male; in color somewhat as in adult female, but light stripes of nail more reddish; pink at sides obscure, much darker, duller, less uniform. Feet as in young male A.

C.² Differing decidedly from young male B; upper parts both lighter and darker, presenting a much more variegated appearance; light brown and gray feathers with whitish edgings at their ends, contrasting strongly with others of brownish black; many of the pallid ends worn and ragged; greater part of head and neck darker, more blackish; the forehead and lores noticeably speckled with brownish white; tail more extensively "buff or pale brown" (looking dead, dry and ready for renewal, like many of the other feathers); lower surface of body less whitish, pale gray faintly spotted with grayish brown on the breast, and changing to an almost uniform grayish brown posteriorly; jugulum brownish black, broken into irregularly by the light color of the breast. Bill (fig. 6) a trifle more swollen; chiefly grayish black, lighter and more grayish in part; the nail streakily blackish and gray at its root; the pinkish color of the sides still more obscure, barely indicated. Feet about as before.

D.³ Plumage with much more black, the black showing extensively over the upper parts (particularly about head, neck, tertiaries, primaries, and tail coverts), the bird being still more brown than black, however; the ends of the brownish feathers somewhat lighter than the rest, but nowhere noticeably so; front of forehead and lores minutely freckled with grayish buff; eye-patch beginning to appear, very short, continued only a very little behind the eye, and dull brownish white, the eye also edged, though not continuously, with this white; lower plumage almost uniform brown, deepening to black about jugulum and crissum. Iris nearly white. Bill (figs. 5 and 8) much more like the adult drake's — differing from it as follows: knob lifted less abruptly; nostrils much less open; basal black of maxilla broader, continued very positively all along the edges and spreading out in front at the sides of the nail; the white field less cleanly white and wholly separated from the purple at each side by a

¹ Described from specimens killed May 4 and 5.

² Described from specimens killed April 22 and May 4.

³ Described from specimens killed May 3.

line of black¹; black of lower mandible continued broadly along lateral edges to the front, the rami wholly black to within about .40 inch of the nail. Feet: outer side approaching unevenly the color of more mature male E; the inner side still as in the younger males.

E.² Plumage much more black than brown, the head, neck, wings, rump and tail coverts almost wholly black; lower surface of body much darker (than in D), more glossy and of a still more uniform brown; eye-patch considerably more extended, but not yet snowy white; nostrils more circular; iris cleanly white. Feet: outer side pinkish vinaceous, sometimes brighter or between rose pink and peach blossom pink; the inner side as in the adult male.

Other specimens, shot Oct. 23 and 27, are similar to these, but the lower surface of the body is of a lighter and less rich brown; the eye-patch more nearly perfect.

F.³ Very near maturity; the black (of plumage) almost uniform; a few scapulars and interscapulars tipped with brown; lower surface of body inclining still to brown (blackish brown); eye-patch nearly or quite perfect; eye continuously edged with white; speculum not yet immaculate, but tips of greater coverts practically clean, and only a few of the secondaries showing dusiness. Bill (fig. 10) more cleanly bright than before, the black only partially separating the white from the side color and less obtrusive elsewhere. Feet: outer side pale (somewhat 'milky') wine-purple, inclining to a warmer or orange tint here and there; inner side rufous or between rufous and vinaceous rufous, and sometimes brighter, or of a slightly pinkish shade of coral red.

One of these nearly mature males, though so nearly all black, is conspicuously speckled with pale buff on the front of the head (or forehead, forepart of crown, and lores), and the knob of the bill (fig. 11) is also somewhat different from any of the others.

In the case of a number of drakes shot Oct. 18 and 21, which are still more fully perfected than the above, the lower surface of the body inclines to gray instead of brown, and is scatteringly flecked with dull white.

Among other interesting facts in this development is the turning light of certain portions while passing from one phase to another. For example: the plumage of the male, which is at first (A) almost uniformly blackish brown, does not mature as one might expect it to do, by growing steadily blacker and

¹ These narrow lines of black (which disappear as the bird matures) are mentioned in one of our ornithological works as characteristic of the bill of *O. fusca*, and as not found on the bill of *O. deglandi*.

² Described from specimens killed April 21 and May 3.

³ Described from specimens killed April 21 and May 3 and 4.

black, or nearer and nearer in appearance to that of the adult, but passes through lighter, less uniform, more and more variegated stages (B and C), and even after steadying down to more simple, more readily comprehended methods of advance (D, E and F), certain portions continue to progress in the same manner as before. Note the description of those males "shot Oct. 23 and 27" which, though placed under E, are intermediate between E and F; the lower plumage, it will be seen, is lighter than in E proper, from which the birds are emerging, and lighter still than the phase F which they are entering. Mark also the conspicuously light forehead and lores of one of those nearly all black, nearly mature males F, and the scattering flecks of white on the still more fully perfected drakes "shot Oct. 18 and 21."

And not in the plumage alone is this uneven course pursued, the coloration of the male's feet is advanced in a similar manner. The outer side of the tarsi and toes, which are at first (A) chocolate color, change to what I describe under E as "between rose pink and peach blossom pink," prior to taking on the less light and less bright "wine purple" of maturity. Though I have used only the male bird in this illustration, the plumage of the female is developed in a like manner.

One reason, perhaps, why the bill of the adult female has always been described as wholly dusky, that no mention has been made of the pink patch at the side of the bill, etc., is that such specimens have been commonly regarded as immature males, whose beaks were just beginning to show the shape and color of maturity. Another reason (furnishing a better excuse) is that comparatively few fully adult birds are secured. A very large majority of the males and females that are shot are immature. The young are not only far more numerous, but they are decidedly less wary, and when hit are oftener killed.

That immaturity has been commonly mistaken for maturity is evinced by most of the descriptions. I copy a few suggestive bits from some of the attempts which have been made to describe the adult female's plumage. "Forehead and cheeks white; under the eye dull brownish; behind that, a large oval spot of white, . . . belly brownish white" (*Wilson*). "Two whitish spots on each side of the head, one near the base of the upper mandible, the other behind the eye" (*Audubon*). Other and

later writers describe it as similarly youthful in appearance; a "whitish patch on the side of the head behind the eye"; plumage of the body "pale grayish below," etc. One work describes it correctly enough as having practically "no white about the head," but includes a contradictory picture which shows very positively both the loreal and auricular patches.

Though—with a single exception to which I allude under phase F—each figure in the accompanying plate is fairly representative of all the individuals of the phase to which it is ascribed, each is taken from a single bird: no one of them is in any degree a composite picture. They are life size, and I have done my utmost to render them accurate, using only fresh specimens as models.

As I wished to give shaded drawings of the bills of the adult female and immature male D, I have included a plain outline also of each for easier comparison with the other unshaded drawings. Some change is discernable in the shape of the bill, even within two or three days after the bird is shot, and before many months have elapsed its original form (like its original color) can only be guessed at. It is in the shape and size of the nostrils, perhaps, that the alteration is most marked. They are much less open, much smaller, terminate acutely at the front, are now far from circular in the adult and nearly adult male, and no longer elliptical in the female and young.

When the bill of a perfectly fresh specimen is measured, its width at widest part is greater than the distance from the nostril to the tip, while in an old skin the width is frequently less than the distance from nostril to tip, and the lateral outlines of the maxilla—which in life are strongly convex—have become (by uneven shrinkage) much more nearly parallel.

I have been greatly impressed, while studying these birds in and out of doors, by the differences between the color of the plumages when fresh and the appearance of the same plumages on dried skins six months or more later. I can now only speak positively about the skins of *deglandi* and *perspicillata*, but I presume that similar changes occur in *americana* and numerous other species. I am not referring to the black of the male which in time becomes somewhat less intense, less glossy, but to the brown plumages of the female and young. These

become less uniform, very decidedly lighter, and materially different in other respects, tending positively to tawny in some cases, to gray in others, where neither tawny nor gray was visible before; and the light edging at the ends of the feathers not only grows lighter, but is extended farther up upon the feather. In most cases, the beginning of such changes is discoverable by close comparison, when a skin is no more than a month old, and it is not too much to say that in a year's time very little or none of the original color is left. These post-mortem deviations seem to be more rapid and radical in such markedly transitional phases as immature and moulting male C, and certain plumages of *perspicillata* of which I will speak at another time.

Though the European and Asiatic White-winged Scoters (*fusca* and *stejnegeri*) are not "our" Scoters, a partial description of them may be useful here. I have never seen the foreign birds alive or in any degree fresh, but through the courtesy of Mr. Ridgway I have been able to carefully examine the skins representing them in the National Museum. That collection, though pretty well supplied with specimens of *stejnegeri*, unfortunately contains but five of *fusca*.

I have compared our New England specimens of *deglandi* with those taken in Alaska and find not the shadow of a difference between them.

The separation of the three species is thus far based almost wholly on the shape of the bill and the distance between front edge of feathering and nostrils. That *fusca*, *deglandi* and *stejnegeri* are at least a good deal alike in size, plumage and general proportions no one can doubt.

I will first describe the bill of *fusca* showing at the same time wherein it is similar to or dissimilar from those of the American and Asiatic species. When no mention is made of the female, my notes may be regarded as referring wholly to the adult or nearly adult male.

Oidemia fusca.

Distance between nostril and loreal feathering considerably greater—at nearest point—than in *deglandi* or *stejnegeri* (not so wide, however, as length of nostril), this distinction applying also to the female. Maxilla

swollen noticeably at sides of base between corner of mouth and nostril, the bill differing in this respect from those of *deglandi* and *stejnegeri*. Though an approximation to this protuberance is sometimes observable in the other species, it is never so prominent and bunch-like. Lateral edges of maxilla somewhat more nearly parallel than in *deglandi*, and about as in *stejnegeri*. Basal part of culmen noticeably elevated, but not nearly so prominently as in *deglandi*, and incomparably less than in *stejnegeri*, rising very gradually and evenly over the nostrils. Anterior extremities of frontal and loreal feathering (in both male and female) about equally advanced.¹

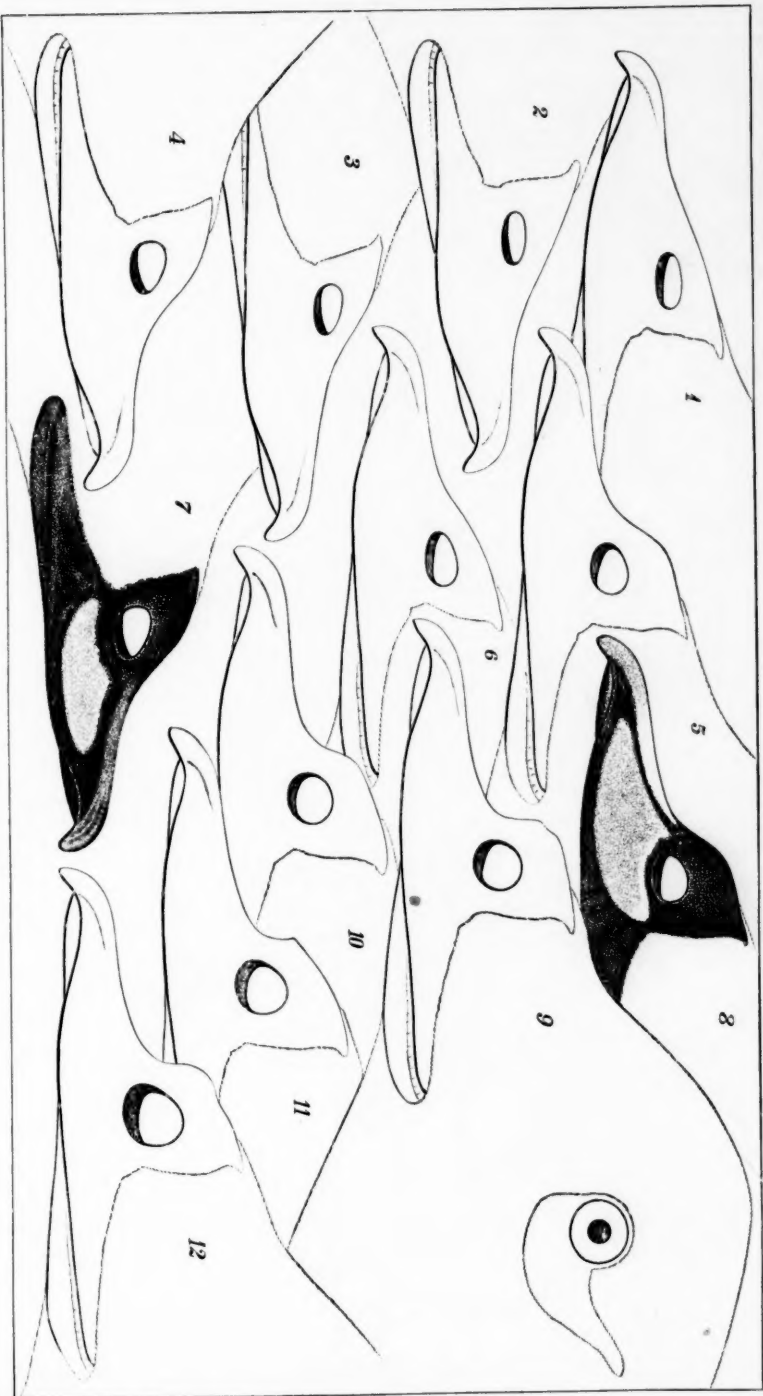
Oidemia stejnegeri.

Average distance between nostril and loreal feathering,—at nearest point,—in both male and female, a trifle greater than in *deglandi*. Frontal feathering seldom, perhaps never, advanced so far forward as the loreal. Knob enormously developed—over once and a half as high above nostrils as the highest knob of *deglandi*, its abruptly rising front decidedly concave, the top jutting forward suddenly and forming an overhanging, very conspicuous, bluntly pointed projection; the culmen somewhat higher at the top of this overhanging portion than at frontal feathers.

The knobs vary greatly even among drakes which at first sight are seemingly mature. Closer inspection shows us that when the front of the knob is not deeply concave, the bird is not fully developed, the basal black is continued far forward, shows more or less all along the lateral edges, and in positive lines running from the black in front of the nostrils to the sides of the nail. (See fig. 8 in which similar lines are indicated for *deglandi*.) On the other hand, when the front face of the knob is deeply concave and its top juts conspicuously to the front, the bill is broadly light, the black lines are absent (or very faintly and brokenly indicated), the black is pushed but a short distance in front of the nostrils, and shows but slightly along the lateral edges. Probably none of the color is at all as it looked in life, but the black marking is distinct enough fully to support what I have said.

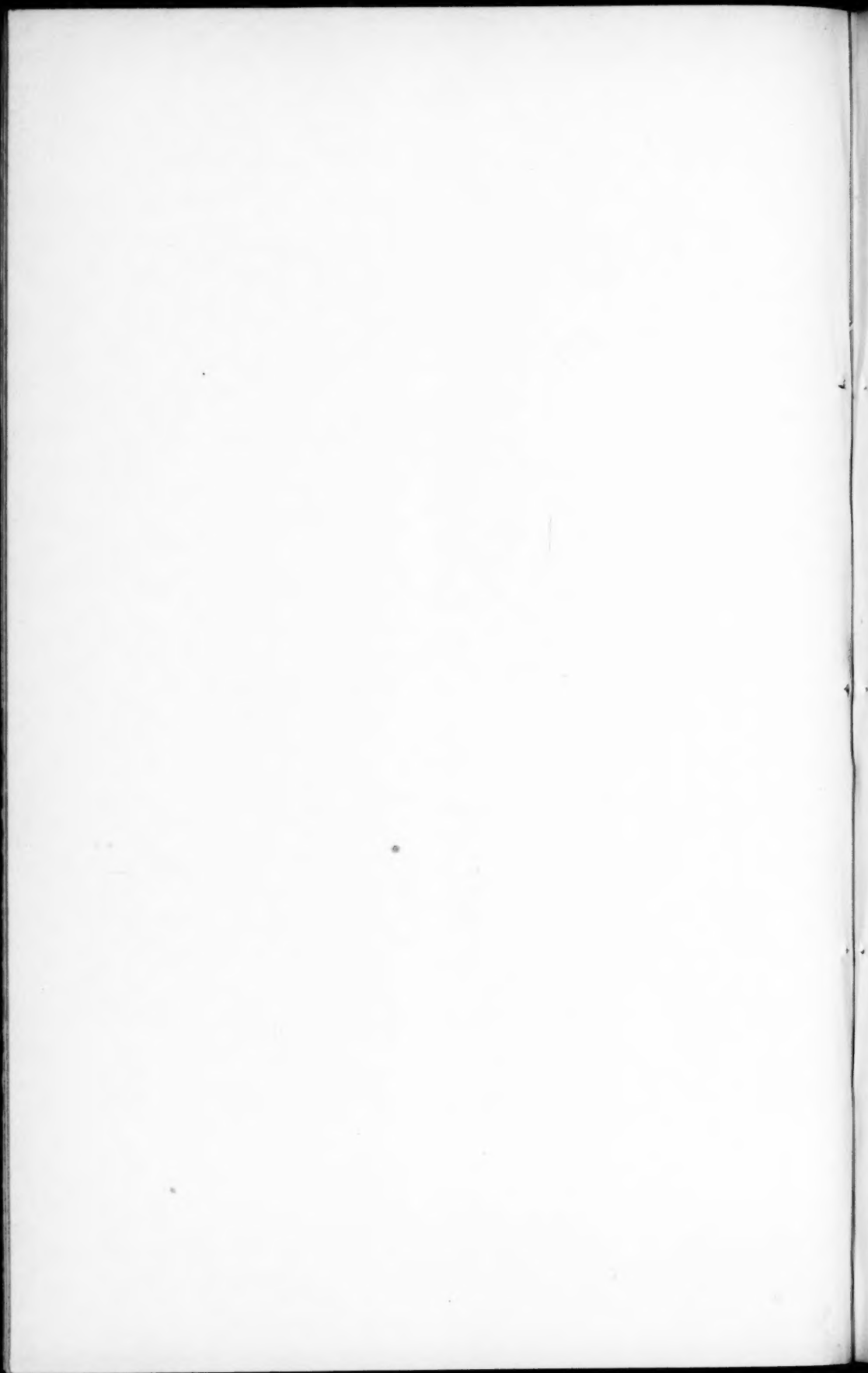
Though the bill passes through innumerable shapes while developing from that of early youth, the culmen line of which is similar to that of fig. 1, none of its late phases closely resemble any of those exhibited by *deglandi*.

¹ I am unable to judge in the case of these bills in regard to the original amount of black and its distribution, as they have been artificially colored. Though the artist who did the work is peculiarly accurate, he was forced to obtain his knowledge of the coloration from very unsatisfactory pictures and descriptions.



BILLS OF OIDEMIA DEGLANDI.

(The males facing to the left, the females to the right.)



OBSERVATIONS ON THE BIRDS OF JAMAICA,
WEST INDIES.

BY W. E. D. SCOTT.

II. A LIST OF THE BIRDS RECORDED FROM THE ISLAND, WITH
ANNOTATIONS.

(Continued from Vol. IX, p. 375.)

147. *Hadrostomus niger* (Gmel.). BLACK SHRIKE. JUDY. MOUNTAIN-DICK.—Said to be common above three thousand feet in the mountain districts. Not observed during my stay on the island.

148. *Tyrannus dominicensis* (Gmel.). GRAY KINGBIRD.—Apparently a migratory species, leaving the island during the winter months. The majority pass through the island, but many remain to breed.

149. *Pitangus caudifasciatus* (D'Orb.). COMMON PETCHARY. PIPIRI.—Very abundant at most points which were visited. This was particularly noticeable in the regions near the sea level. Above fifteen hundred feet elevation, at least in the winter, they were not nearly so common, but Gosse ('Birds of Jamaica,' p. 178) says that he has observed them at Bluefields Peaks. At Priestman's River, on February 14, these birds were generally building nests, and the breeding season was fairly begun.

150. *Myiarchus validus* (Cab.). TOM-FOOL.—This does not seem to be a very common species, and I did not meet with it, except on two occasions, below twelve hundred feet above the sea. At Stony Hill it was more common than at any other point visited, but even here it was among the rarer birds. In general habits and appearance it reminds one very much of *Myiarchus crinitus*.

151. *Myiarchus stolidus* (Gosse). LITTLE TOM-FOOL.—Commoner than *M. validus*, and much more generally distributed. Though met with more commonly at Stony Hill than at other points, yet a few were noted at all places visited, though in the immediate vicinity of the sea I did not find them. Gosse does not seem to have been acquainted with *M. validus*, and speaks of this species only in a general way. According to him it breeds in hollow stumps, about the last of June or in early July, as young were taken from such a location, grown so as to be recognized, in August ('Birds of Jamaica,' pp. 168-169).

152. *Blacicus barbirostris* (Swains.). FLAT-BILL.—This was the commonest Flycatcher observed at Stony Hill, and was an abundant bird at that point. At Boston, near Priestman's River, though seen several times, it was not nearly so abundant as at the higher altitude of Stony Hill. The breeding season had not begun, nor was it imminent, when I left the island.

153. *Contopus pallidus* (Gosse). BUFF-WINGED FLAT-BILL.—This appears to be another species more common above than below a thousand feet above the sea. At Stony Hill I saw them frequently and procured a fine series of individuals, but at the sea level in the vicinity of Priestman's River they were not observed, while on the foot-hills a mile or more back from the salt water a few, two or three, were taken during the two months spent in this region. Its habits seem to resemble closely those of *Contopus virens*.

154. *Elainea cotta* (Gosse).—A rare species at points that I visited. On December 9, at Stony Hill, a female (9567) was taken. It was feeding on low bushes near the ground and acted much more like a *Dendroica* than a Flycatcher. On January 8 one was taken near the house at Boston, and on February 13 a male (11,120) and a female (11,121) were taken, evidently mated. On dissection these birds showed that the breeding season was about six weeks distant. These four are all the records made during my stay.

155. *Elainea fallax* (Scl.) Said to be very rare. Not met with at the points visited.

156. *Corvus jamaicensis* (Gmel.). GABBLING CROW. JABBERING CROW.—These birds were not uncommon at a point known as Egg Hill, about three miles inland from Priestman's River and about one thousand feet in altitude. Here, in a practically unsettled wilderness, I procured some six or eight individuals at various times, and this was the only point where I observed them. For an excellent account in much detail, as to habits and so forth, the reader is referred to Gosse ('Birds of Jamaica,' pp. 209-217).

The Black-headed Jay (*Cyanocorax pileatus*) (Temm.) has been recorded from Jamaica by Gosse ('Birds of Jamaica,' p. 208), but its occurrence must have been accidental.

157. *Dolichonyx oryzivorus* (Linn.). BOBOLINK. BUTTERBIRD. OCTOBER PINK. PINK.—A very abundant migrant in October and April. Does not winter.

158. *Nesopsar nigerrimus* (Osburn).—Not met with. This species, from all I have been able to learn, is local in its distribution, and nowhere common.

159. *Icterus icterus* (Linn.). TROUPIAL.—Cited by authors as an introduced species. I did not meet with it, and it apparently does not occur on the island in a wild state at present.

160. *Icterus leucopteryx* (Wagl.). BANANA-BIRD.—A common resident species and generally distributed. The plumage of the sexes cannot be distinguished when the birds are adult. No. 9729, adult female, Stony Hill, Dec. 15, 1890, and nos. 10,703 and 10,704, both adult females, Priestman's River, January 28, 1891, do not differ in appearance in any way from adult males in highest plumage. Other instances might be cited. But young birds and birds probably up to the second year are not nearly as highly colored as adult birds. This seems to have nothing to do with

sex. At Boston the birds were quite common, and were mated before I left that point. Though not powerful singers like *Icterus galbula*, the birds have a very pretty song and the females seem to be as musical as the males. From many birds dissected I should think they would breed about the last of April or the first part of May.

161. *Quiscalus crassirostris* (Swains). TINKLING GRACKLE. BARBADOS BLACKBIRD. SHINING-EYES.—This bird was not observed in the vicinity of Kingston or at Stony Hill, but at Port Antonio and Priestman's River, they were not at all uncommon. They are gregarious, though the parties that I saw rarely consisted of more than six or eight individuals. Aside from the tinkling, melodious, call note they have a series of notes, that I have frequently heard given, that may fairly be called a song, and a very pretty, though not varied, one.

162. *Sicalis flaveola jamaicæ* (Sharpe). This is stated by Gosse to have been a common species, but apparently of very local distribution at the eastern part of the island. I was unable in my limited stay to visit the points indicated, and refer the reader for greater detail to Gosse ('Birds of Jamaica,' pp. 245-247).

163. *Ammodramus savannarum* (Gmel.). TICHICRO. GRASS PINK. SAVANNA-BIRD.—This was a common species in the grass fields about the Constant Springs Hotel, and just back of that locality. Here they were abundant, but as my series was collected in December, 1890, and just after the close of the breeding season, I have no proper material for a close comparison with the North American subspecies. All the birds I procured were moulting or in a very worn plumage.

Mr. Taylor tells me that he does not know of any other point on the island where the birds occur. There were apparently suitable localities at many points near Port Antonio and Priestman's River, but careful search failed to reveal their presence.

164. *Habia ludoviciana* (Linn.). ROSE-BREASTED GROSBEEK.—This is included on the authority of Mr. Hill (Gosse, 'Birds of Jamaica,' p. 259.)

165. *Euetheia bicolor* (Linn.). This was a rather common species at Stony Hill, and had only just finished breeding on my arrival at that point. I did not see the birds about Constant Springs nor in the immediate vicinity of Kingston. At Priestman's River they were uncommon, not more than a dozen being seen and taken during my stay.

166. *Euetheia olivacea* (Gmel.). (*Spermophila adoxa* Gosse, 'Birds of Jamaica,' p. 253.) YELLOW-FACED GRASSQUIT.—An abundant species, and of general distribution. It is perhaps most common at the lower altitudes.

In the vicinity of Priestman's River birds were observed carrying material for nest building early in January. On February 3 at this point an individual (No. 10,878) was taken which proved on dissection to be a female. In external appearance it was like the average male bird of the species, having the black of the head and throat intense and the orange

face marks very bright. Many females taken show this condition to some degree, but this is the only one in a large series indistinguishable from the adult male.

167. *Loxigilla violacea* (Linn.). COTTON-TREE SPARROW. BLACK BULLFINCH. COFFEE-BIRD.—A common species at the points visited, but it seemed more abundant at the lower altitudes than at Stony Hill and points higher in the mountains. In a large series before me there are many females quite as brightly colored as the more intense males, and indistinguishable from that sex in its highest plumage by any external features of color or appearance. Three females taken on February 16 were about to lay the first egg. The only song I heard from these birds was a series of rather weak notes, four or five in number, the last given with rather more emphasis than the others.

168. *Loxigilla anoxantha* (Gosse). YELLOW-BACKED FINCH.—This was a rather common bird at most points visited, though I did not see it at all during my stay at Constant Springs. At Stony Hill it was fairly common, but only a few were observed or taken at Priestman's River. It appears to be a species more common in the hills and higher altitudes than in the lowlands near the sea. I made no notes as to its nesting but Gosse ('Birds of Jamaica,' p. 248) speaks of finding a nest in June. On January 17 on the hills above Priestman's River, altitude 1000 feet, I took a young female (10,440) that apparently had not been long from the nest. Another (10,624) taken near the same locality on January 24 was still younger.

169. *Euphonia jamaica* (Linn.). BLUE QUIT.—At all points which I visited this was one of the most abundant and conspicuous of the fruit-eating birds. At Stony Hill they were gregarious and were feeding on the mango fruit and the sour sop. I also saw them in large companies in the vicinity of Constant Springs, and perhaps more abundantly at Priestman's River. They were equally common at all altitudes I visited.

Gosse ('Birds of Jamaica,' pp. 238-242) gives so detailed an account of the nesting, etc., of this bird that the reader is referred to the work cited.

170. *Spindalis nigricephala* (Fameson). MOUNTAIN BULLFINCH. ORANGE-BIRD. BANANA-BIRD. CASHEW-BIRD.—Another gregarious, fruit-eating species, and one of the more common and conspicuous birds of the island. At Stony Hill they were seen almost daily in parties of from three to ten, and more rarely a single individual or a pair. At Priestman's River they were abundant and found in similar small companies in the vicinity of any fruit-bearing trees, particularly mango, sour sop, and the like. On January 14 at Priestman's River individuals of both sexes were observed carrying material for nest building.

171. *Piranga erythromelas* (Vieill). SCARLET TANAGER.—This is apparently a rare migrant, passing through the island in March. There are no recent records and the reader is referred to Gosse ('Birds of Jamaica,' p. 235) for greater detail.

172. *Progne dominicensis* (Gmel.). GREAT BLUE SWALLOW.—Migrant and summer resident, a few wintering. Observed only once during my stay. This was at Priestman's River on February 5 when large numbers of birds, unquestionably this species, though none were obtained, appeared in company with many *Hemiprocne zonaris*. For a full account see Gosse ('Birds of Jamaica,' pp. 69-72).

173. *Petrochelidon fulva* (Vieill.) CUBAN CLIFF SWALLOW. CAVE SWALLOW.—An abundant resident species, especially near the coast, and not so common in the interior of the island. The caves, before referred to in this series of articles, in the faces of the cliffs along the shore, were favorite roosting and resting places for this species, and probably the birds bred here later in the year. Hundreds could be seen, about sunset, retiring to these caves at Priestman's River.

174. *Chelidon erythrogaster* (Bodd.). BARN SWALLOW.—Not observed. Included by A. and E. Newton ('Handbook Jamaica,' 1881, p. 107).

175. *Tachycineta euchrysea* (Gosse). GOLDEN SWALLOW.—This species seems of very local distribution. During the months spent on the island it was not even noted. From all that can be learned it is confined to the higher altitudes where it is resident and only common locally.

176. *Clivicola riparia* (Linn.). BANK SWALLOW. Not observed. Recorded by A. and E. Newton ('Handbook of Jamaica,' 1881, p. 107).

(To be concluded.)

SUPPLEMENTARY REMARKS ON THE GENUS *PITTA*.

BY LEONHARD STEJNEGER.

MR. D. G. ELLIOT's recent paper in 'The Auk' (*antea*, pp. 51-52) on the Genus *Pitta* Vieillot, suggests a few remarks.

The earliest publication of the name *Pitta* is either in the 'Analyse' or in the fourth volume of the 'Nouveau Dictionnaire d'Histoire Naturelle,' pp. 355-358. Both publications bear the same apparent date, viz., 1816, but internal evidence would

indicate that the 'Analyse' was published later.¹ The diagnosis in the 'Dictionnaire' is also much fuller, and several more species are mentioned than those figured by Buffon in the 'Planches Enluminées.' And here is another point, viz., that Vieillot's genus, as well as the French name 'Brève,' is not taken from Buffon, properly speaking, but from Montbeillard (Hist. Nat. Ois. III, 1775, p. 412).² In this are mentioned four species only, viz., Pl. Enl. Nos. 89, 257, and 258 (*but not at all No. 355!*) and Edwards' pl. 324.³ The latter is *Pitta brachyurus* (LINN.), being in fact the basis of the name, and the type of *Eucichla* is not mentioned at all. This simplifies the elimination process greatly, the result being, as Mr. Elliot has already decided, that the name *Pitta* belongs to the short-tailed group and can only belong to it! But as for the type of it, I think Sclater is right in giving it as *P. brachyura*. Were we to take the first species mentioned by Vieillot, the type would be *Pitta cyanura* VIEILL. which Mr. Elliot has just decided is the type of *Eucichla*! Besides, no code of nomenclature provides for the selection of the type by taking the first species. The A. O. U. Code distinctly provides for the process of elimination; and if that be applied I think it will be found that *P. brachyura*, mentioned both by Montbeillard and by Vieillot, must stand as *the* type.

The mention of the name *P. brachyura* raises another question, viz., that of the specific appellation of these birds. Sclater (Cat. Bds. Br. Mus., XIV) gets very easily around the matter by

¹ Quite a number of names *not* in the first four volumes of the 'Dictionnaire' are found in the 'Analyse,' making it probable that they were invented later, for instance, *Acridotheres*, *Alectrurus*, *Aramus*, *Ægialites*, *Anerportes*. The case of *Alectrurus* is particularly interesting, for on p. 68 of the 'Analyse' the original *Gallita* was not changed, probably by an oversight, while in the text proper it was changed to *Alectrurus*, but too late to get the new name into the 'Dictionnaire.' True, Vieillot in the latter under *Astrurine cendrée* refers to the 'Analyse,' but that does not prove that it was published or even printed at the time, especially as no page is quoted.

² I quote this edition, because it is evidently the one Vieillot refers to in the 'Dictionnaire' (l. c.) as follows: "Montbeillard les [i. e. les brèves] a isolées d'après les différences de conformation extérieure par lesquelles, dit-il, la nature elle-même les a distinguées." As a matter of fact Montbeillard (l. c.) is the creator of the genus ("Je n'ai pu m'empêcher de séparer ces oiseaux d'avec les merles, voyant les différences," etc.), while Vieillot only supplied the Latinized name.

³ Sclater, consequently, is correct in saying that *all* belong to the short-tailed group.

simply querying the identification of Buffon's plates. But the figures in question are too well made to justify such a proceeding. There can be no doubt that Edwards' pl. 324 faithfully reproduces the common Indian species. Sclater admits this by adopting the name, but he adds *Turdus coronatus* MÜLLER to the synonyms, though with a query. This is unnecessary, for nothing can be more certain than the fact that Pl. Enl. 258 represents a bird with the whole head, including the throat, black. With the exception of the absence of red on the belly and under tail-coverts the latter plate agrees exactly with Temminck's *P. irena*. The fact that the red is also missing in Pl. Enl. 257, otherwise indistinguishable from Temminck's *P. cyanoptera*, makes it extremely probable that the absence of the red is due to the same cause, either to age, the red being very pale and dull in the young, or possibly to the manner of preservation of the skins, or to fading. I may mention that I have before me an undoubted adult bird of the latter in which the red is almost entirely gone (U. S. Nat. Mus. no. 14,456; U. S. Expl. Exp.). The difficulty arising from Buffon's giving the habitat of no. 258 as "Bengale," while *P. irena* inhabits the island of Timor, is easily overcome by the fact that Brisson, in describing the same specimen, says that it came from the Moluccas, and as a matter of fact, Sclater does not query the pertinancy of Brisson's description. Oates (Bds. Br. Ind., II, 1890, p. 392) seems to accept the identification of Pl. Enl. no. 257, but he gets away from Müller's name *P. moluccensis*, because it "conveys an erroneous impression of this bird's habitat." Apart from the unsound principle involved in allowing the rejection of a name even on such a ground, there is another reason for disagreeing with him, viz., that it appears that those older authors did not always restrict the name Moluccan Islands to only those which are so called to-day.

Finally, Mr. Elliot in his paper alludes to the genus '*Coracopitta*.' The fate of the name of this genus is strange indeed! I have been accused of having "showered" new names upon the ornithological public in my portion of the bird volume of the 'Standard Natural History,' yet my accusers do not find it worth their while to go to that book for names when they need new ones; they would rather add to the 'shower'! In the volume

alluded to, p. 466 (1885), I substituted *Mellopitta* for *Melanipitta*, preoccupied, being careful not to deviate too far from the original name, in order to minimize the change. Sclater, three years later (Cat. Bds. Br. Mus., XIV, p. 449) adds his *Coracopitta* to the list of synonyms. I at once called the attention of ornithologists to this fact (Auk, 1889, p. 79) and Count Salvadori did the same in the Ibis (1890, p. 124), but apparently to no purpose, for in 1892 Mr. Sharpe (Cat. Bds. Br. Mus., XVII, p. 7, foot-note) proposed the amended name of *Coracocichla* alleging *Coracopitta* to be preoccupied, because Bonaparte, in 1854, *ought* to have written *Coracopitta* for *Corapitta*! Surely this 'shower' of names could easily have been avoided, while I will assert that the changes which I undertook in the 'Standard Natural History' were unavoidable and necessary under the A. O. U. Code of Nomenclature. A further study of that volume might prevent other unnecessary changes in the future. Thus one may find *Atrichornis* substituted for *Atrichia*, preoccupied, though still employed in 1890 in the thirteenth volume of the 'Catalogue of Birds in the British Museum'; also the name *Alopochen* for *Chenalopex*, preoccupied (not in Waterhouse's Index Gen. Av.), but these are by no means the only ones.

VIEILLOT'S 'ANALYSE' AND BUFFON'S 'BRÈVE.'

BY D. G. ELLIOT.

By the courtesy of Dr. Stejneger I am placed in possession of proofs of his article on the genus *Pitta*, published in this number of 'The Auk,' and am therefore enabled to discuss some points in his paper, without being obliged to wait three months for the opportunity to state my views in this journal.

With the greater portion of Dr. Stejneger's paper I am in complete accord, and as regards the proper names to be borne by the Pittas mentioned by him I have for many years contended that those given in his article were the only correct ones, in spite

of the adverse criticism and practice of my ornithological friends in the Old World, and in my forthcoming monograph of the family the species will appear under the names as given by Dr. Stejneger.

But on one or two points I find myself unable to agree with my friend's views, and although perhaps they may not be of very especial importance so far as the Pittas are concerned, yet as the conclusion Dr. Stejneger has reached would seem to antedate the publication of the 'Analyse' by the 'Nouveau Dictionnaire,' and so seriously affect many genera and species published in the former work, it is perhaps as well to consider the value of the evidence our author relies upon to maintain his position. His proofs, why the 'Analyse' was the last published, are that quite a number of names contained in that work are *not* found in the first four volumes of the 'Nouveau Dictionnaire'; consequently the latter must have been issued first, and although under the name *Asturia cinerea*, Vol. III, a reference is made to the 'Analyse,' yet as no page is given, this is an additional reason that the 'Dictionnaire' was published first. These are, I believe, all the proofs presented by Dr. Stejneger, and on which he rests his case.

Let us see, therefore, how the evidence obtained from a careful investigation of the work in question affects his position. The 'Analyse' is dated 1816. With no evidence to the contrary we must acknowledge that it was published during that year. The 'Nouveau Dictionnaire' is in a great measure a recapitulation of the 1803 edition, somewhat amplified, but the revision and addition of new matter, so far as Vieillot is concerned, is done hastily and imperfectly. The fact that the thirty-six volumes were issued in four years shows how rapid was the publication — Vols. I–VI in 1816, Vols. VII–XVIII and XXV in 1817, Vols. XIX–XXIV and XXVI–XXVIII in 1818, and Vols. XXIX–XXXVI in 1819, — or, in 1816 one volume every two months, in 1817 more than one a month, in 1818 one in a little over a month, and in 1819 a little over one every two months. (It is possible that the date of Vol. XXV (1817) is a typographical error.) If, therefore, the revision of these volumes was accomplished anywhere near the dates of their publication, it need cause no surprise that omissions occur in them. Dr. Stejneger's argument affects only the

first six volumes published in 1816, because I gather nowhere in his article that he denies that the 'Analyse' was issued in that year.

Now, in regard to the first citation of Dr. Stejneger, that the omission of names from the 'Dictionnaire' which appear in the 'Analyse' is a proof that the former antedates the latter, it must be of course admitted that if these omissions occur only in the volumes published in 1816, and never in the later volumes, after, even as Dr. Stejneger will acknowledge, the 'Analyse' was published, his case would be a very strong one indeed; but what are the facts? I have looked up in the 'Dictionnaire' every name given by Vieillot on pages 68, 69, and 70 of the 'Analyse,' with the following result. Of new species there are sixteen, of which thirteen are mentioned in the 'Dictionnaire,' but unfortunately for Dr. Stejneger's argument, the volumes in which all of the absent ones should appear were published *after* 1816. These species are *Musophaga cristata*, *Tyrannus cinereus* and *Phænicopterus parvus*. Of the "nouveaux noms" taken from the Greek there are ninety-one mentioned. Of these *twenty* are not given in the 'Dictionnaire,' although *thirteen* of the missing twenty should have appeared in the volumes issued *after* 1816. It would therefore seem very clear that because any name is omitted from the 'Dictionnaire' that is contained in the 'Analyse,' is no evidence whatever that the former antedates the latter, for if it were for the first six volumes issued in 1816, it would be equally so for the rest, and then it might be claimed that the 'Analyse' was not published until after 1819!

Of all the names given on pages 68, 69, and 70 of the 'Analyse,' to only *four* is any reference made in the 'Dictionnaire,' viz., *Asturia cinerea*, Vol. III, 1816, *Ortygodes variegata*, Vol. XXIV, 1818, *Pica rufiventris* and *Physeta*, both in Vol. XXVI, 1818, the last three mentioned two years after the appearance of the 'Analyse'; but with none of them is any page of Vieillot's pamphlet cited, which proves, if it proves anything, that he was not in the habit of giving the page. This really is the fact, pages hardly ever being cited from any work, but the numeration of the *plates* often, and therefore the absence of page number cannot possibly be advanced as an argument to prove that the first six volumes of the 'Dictionnaire' were published before

the 'Analyse,' but that on the contrary in the one instance in Vol. III he referred to his work in the same way as he did in Vols. XXIV and XXVI, as actually published and in existence, which Dr. Stejneger acknowledges to be a fact at the date of the last two volumes. It will thus be seen that the reasons given by Dr. Stejneger for his belief that the 'Analyse' appeared after the first six volumes of the 'Dictionnaire' fail to support his view, but that the evidence tends directly against it, and more strongly to confirm our belief that the 'Analyse' was a prior publication.

The second point in which I take issue with our author is that the species of Vieillot's genus *Pitta* and those of the French name Brève are not taken from Buffon (although Vieillot expressly states they are), but from Montbeillard, and he quotes the 'Histoire Naturelle des Oiseaux,' Vol. III, 1775, p. 412—an edition of eight volumes 1770-1781. In this volume four species are given under Brève as stated by Dr. Stejneger, and one as 'L'Azurin,' which is *Pitta guiana* P. L. S. Müller, the *Brève de la Guiane* of plate 355 of the 'Planches Enluminées.'

The standard edition of Buffon's Hist. Nat. Ois., commonly known as the 'Planches Enluminées,' is in ten volumes published from 1770-1786; and this is the work usually understood when any reference is made to Buffon concerning birds, and the one generally quoted. Why Dr. Stejneger should deem it necessary to select something else, and so endeavor to make Vieillot, when he designates in the 'Analyse' "Buffon's Brèves" as the species for his genus *Pitta*, include any not mentioned in the work above referred to, seems strange, as so little is to be gained by it anyway. The word *Brève* is a French term universally applied to the species of *Pitta*, the same as *Colubri* or *Oiseaux-mouches* is to Hummingbirds, and includes all the species comprised in the family. That Vieillot regarded 'L'Azurin' as a *Pitta* (no matter what Montbeillard considered it) is shown in the 'Dictionnaire,' Vol. IV, p. 356, where he calls it 'La Brève Azurine,' and if Dr. Stejneger considers that the 'Analyse' was published after the 'Dictionnaire,' then this species must be included in Vieillot's genus *Pitta*, because it is in both the edition quoted by him as well as in plate 355 of the standard edition, and therefore his volume would contain five Pittas against four in the work from which I quote, in either case making *Pitta* a composite genus containing both long- and short-tailed species.

What the type of *Pitta* may be is of no consequence whatever at the present day; but by no process of elimination that I know, either of the A. O. U., or any other Code, can a genus which has been proposed to include four short-tailed birds (as is the case with Dr. Stejneger) or three (as is the case with Volume IV from which I quote of the 'Planches Enluminées'), all generically alike, be narrowed down to compel the selection of one species only, when no genera have been accepted for the reception of any of the others. Under such circumstances it is usual, I contend, (no especial species having been indicated by the author of the genus) to select the one first mentioned, which in both works cited is Pl. 89, Brève des Philippines, *Pitta sordida* P. L. S. Müller, as given in my paper on the genus *Pitta*, and (if he is unwilling to accept this species) I can see no reason whatever why Dr. Stejneger should ignore plates 257 and 258, the *Pitta moluccensis* Müller and *Pitta coronata* Müller (generically the same as Edwards's species on plate 324 of his work), both given in the volume he cites, in order to pick out a bird not figured by Buffon at all, and not even mentioned in the standard work from which I have quoted.

As to Montbeillard being the author of the volume from which Dr. Stejneger quotes, he is equally so in the one to which I have made reference, and his name in conjunction with Buffon is given as co-author of the 'Planches Enluminées,' and it was natural for Vieillot to mention him, but we should by no manner of means imagine that by so doing he denied to Buffon any authorship in the work; but, by giving in the 'Analyse' Buffon's Brèves as the species he intended to be contained in his genus *Pitta*, he meant those included in the 'Planches Enluminées' and there figured, and not Edwards's species of which Buffon makes no mention in his completed edition.

In conclusion I would point out the fact that, in the 'Dictionnaire,' Vieillot refers to the complete edition of the 'Histoire Naturelle des Oiseaux,' 1770-1786, and enumerates only as found in Buffon's work the four species represented on plates 89, 257, 258 and 355, the last being Vieillot's *Brève azurine*, and although he gives in his list with others not in the 'Planches Enluminées,' the *Brève de Ceylon* as figured on plate 324 of Edwards's 'Birds,' he nowhere refers to it as belonging to the species he included in his genus *Pitta*, viz. Buffon's Brèves.

RECENT LITERATURE.

Keeler on the 'Evolution of the Colors of North American Land Birds.' — Mr. Keeler's book is audacious and in some respects unique. At many points the author stalks with a bold tread where more experienced investigators would hardly dare to step. In this work an attempt is made to give a detailed explanation of how and why the land birds of North America have acquired their tints and markings. The subject chosen is thus one that might well be selected for the crowning work of a long life of special research instead of the maiden effort of one who has still his spurs to win in the field of zoölogical investigation. Mr. Keeler gives evidence of possessing a highly speculative turn of mind and considerable originality of thought. He also shows that he has made himself fairly conversant with the literature relating to the general subject of evolution, and that this is his chief preparation for the work in hand, it being painfully evident that he is seriously handicapped in his undertaking by lack of experience and familiarity with exotic birds.

Before passing to a detailed notice of his work, we will transcribe the opening paragraph of his preface: "The present paper has been written more with the hope of stimulating thought and inciting research in a new and as yet almost untrodden field of ornithological inquiry, than with the expectation of reaching definite results. The subject is as yet too new and difficult to be reduced to even the semblance of an exact science, and accordingly all the views here set forth are more or less provisional and tentative. I have constantly proceeded upon the assumption that a poor theory is better than no theory, provided it be not considered as final, since it affords an opening wedge for the further study of a subject. Accordingly many of the views here set forth are hardly to be considered as more than guesses, and it is expected that future study will serve to show their fallacy. If they lead to further study, however, and to more exact and comprehensive work by others, I shall be glad to see them overturned and their places filled by more worthy hypotheses."

The attitude here assumed is commendably modest, but it is hardly borne out by the general tenor of what follows. We cannot agree with him, however, that "a poor theory is better than no theory," even if it is put forth tentatively; we believe it is much better, and far safer for the best interests of science, to confess ignorance on abstruse points than to set forth views that "are hardly to be considered as more than guesses,"—in other words, hap-hazard conjectures, which may or may not have an element of probability, according to the fitness of the guesser to

¹ Evolution of the Colors of North American Land Birds. | By | Charles A. Keeler. | San Francisco: | California Academy of Sciences. | January, 1893. 8vo, pp. xii + 361, pll. xix. = Occasional Papers of the California Academy of Sciences, III.

express an opinion on the question at issue, or his proneness to give rein to his fancy on slight provocation. It is obvious that a *wrong* theory is worse than no theory; for to the lay reader or half-informed student who is unable to discriminate properly between the probable and the improbable, it is sure to be positively misleading. Pure speculation is the bane of science; it misguides the uninitiated and disgusts the well-informed. Many writers more gifted with imagination than with knowledge have contributed largely to romance under the guise of science, and especially is this the case in the present field which includes such topics as Mr. Keeler here treats.

We do not wish this to be construed, however, as a wholesale condemnation of Mr. Keeler, or of theorizing in general; on the contrary we find much to commend in Mr. Keeler, and recognize the absolute necessity of hypotheses in scientific research; we wish merely to emphasize the fact that there is much natural history romancing which has wide currency as 'science.' A fair acquaintance with current theories respecting a few special phases of the subject of evolution, a merely superficial knowledge of the underlying principles, and a vast ignorance of the facts, of biology at large, is too apt to form the equipment and the incentive of some of our boldest theorists in the field of speculative biology, for whom nature has no secrets beyond their power to explain. This, indeed, is our estimate of much of the speculative writings of Poulton, Romanes, Weismann, and many other writers who have of late been so prolific of explanations of the abstruse things in nature, whom Mr. Keeler so freely quotes, and whom he has evidently taken as his models. He has, however, shown in general less discretion and more recklessness in his conclusions and generalizations.

Mr. Keeler's work consists of two parts, an 'Introduction,' occupying the first 132 pages, the remainder being devoted to 'The Colors of North American Birds' (pp. 132-336). Then follows a bibliography, explanations of plates, and an excellent index. The first part treats of general questions, such as 'The Inheritance of Acquired Characters' (pp. 2-50), 'Variation and Natural Selection' (pp. 50-63), 'Laws conditioning Evolution' (pp. 64-80), 'Sexual Selection' (pp. 80-102), 'The Nature of Species' (pp. 103-109), and 'Isolation as a Factor in the Evolution of Species' (pp. 110-132).

As Mr. Keeler says, in view of the disagreement between the leading writers of the different schools, "it is quite impossible to undertake any general scientific investigation in the field of evolution without a tolerable survey of the whole ground." As he further says: "There is hardly one of the important doctrines concerning which a consensus of scientific opinion has been attained. To be sure, all maintain that Darwinism or natural selection is a factor in evolution, but while some hold it to be the only factor, and all-sufficient in the creation of species, others believe it to be a very minor agency, and relegate it to the post of inspector-general of the army of life. With regard to sexual selection the

same diversity of opinion prevails, one school advocating sexual selection as the sole agent in producing the brilliant colors and varied plumes of male birds, etc., the other extreme asserting that sexual selection as a factor in evolution is a myth. Still greater is the diversity of opinion and more intense the feeling in regard to that momentous question which is at present agitating the troubled sea of scientific thought—the transmission of acquired characters.”

Concerning all of these leading questions Mr. Keeler spreads before his readers the pros and cons of the argument as presented by leading champions, giving a concise history and impartial summary of the contesting theories. Mr. Keeler also now and then attempts to weigh the evidence brought forward by the different opposing advocates, but for the most part maintains a position of neutrality or judicial reserve to such an extent that it is sometimes difficult to see which side of the case he favors, till we reach his final summing up of the subject.

In discussing the inheritance of acquired characters he appears to allow great weight to the supposed distinction between the inheritance of a habit or the modification of a structure and the inheritance merely of a “constitutional tendency” to a given habit or to a given variation—a distinction we confess too occult for our comprehension. At the close of his discussion of heredity he says: “From all this we may come to a provisional conclusion that acquired characters are transmissible. We are justified in using this assumption as a working hypothesis, and in feeling confident that future investigation will place it upon a footing where it is beyond the possibility of refutation.” For this concession we are duly grateful!

Mr. Keeler admits himself to be a strong convert to the theory of sexual selection as he interprets it, and that it affords “a tolerably complete explanation of secondary sexual characters in birds,” after considering the evidence, pro and con, at considerable length. We are quite unable, however, to see the evidence as it appears to him; or at least to accept the principle of sexual selection as he applies it in the second part of his work; in other words, that the secondary sexual characters among birds, or among any other animals, are due to any great extent to voluntary selection on the part of the female. The subject is of course too broad to admit of discussion in the present connection.

Mr. Keeler, we are glad to see, gives the cold shoulder to Mr. Romanes's rather baseless theory of ‘Physiological Selection,’ which has already received many well-merited thrusts, since it is primarily based upon an assumption not only impossible to prove in the slightest degree, but at the same time seemingly of the utmost improbability.

In the two hundred and odd pages devoted to ‘The Colors of North American Birds’ there is much that is suggestive and worthy of commendation, mixed with a great deal that is weak and unphilosophical, which on the whole leaves a feeling of regret and disappointment, when compared with the able presentation of the subjects treated in the first third of

the work under review. In his account of 'Modes of Plumage Changes' is an erroneous interpretation of the change of color in the young Arizona Hooded Oriole, the conclusion being reached that the "transition in this species is by an addition of pigment without moult." With part of the same material in hand that formed the basis of Mr. Keeler's conclusion, and much more of similar character representing a large number of other species, it is evident that he has misunderstood the facts in the case,—namely, that a common mottled transition stage of plumage has been mistaken for an actual change of color without moult. It is evident that this mottled phase of plumage, occurring in a very large number of species, is a permanent one for the time being, varying greatly in different individuals of the same age, and not a gradual color change without moult. This, of course, is not proof that there is never any change of color without moult, the only satisfactory proof of which, however, must obviously be based on observation of the living bird for a sufficient period to determine the nature of the change of color. Under 'General Principles of Color in Birds,' we are at a loss to see why the pigment should be considered any more a "product of waste" than the feathers themselves, or other portions of the integument. Mr. Keeler calls attention to "a curious parallelism between the colors" in species of *Pipilo* and *Setophaga* (p. 147), "which may be only a coincidence or may be a matter of profound significance." This being the case, how about similar parallelisms between these genera on the one hand and others in Australia, India, Africa, and South America? Or the cases of almost exact parallelism in pattern of coloration, and often even in color, of wholly unrelated genera in widely separated parts of the world, which occur over and over again in a considerable number of very distinct styles of coloration? The *Pipilo* style, the *Junco* style, the *Sturnella* style, the *Icterus* style, the *Minus* style, and so on, occur over and over again among Old World birds; certain African Weaverbirds repeat the red shoulder spots of *Agelaius*, etc., while in other cases this same marking is repeated in blue, white, or yellow.

There is space to notice very few of the striking generalizations that occur so frequently in the second third of the book, but a few may be cited in illustration of the general criticism we are forced to make upon Part II as a whole. From reading pages 159-161 one would infer that the feather first grew to its proper size and form and was then decorated by the subsequent deposit of pigment, for we read: "Pigment is a definite chemical substance which travels through the various branches of the feather, advancing farthest and most rapidly along the lines of least resistance and accumulating in masses where the resistance is greatest. Now the pigment cells must reach the various parts of the feather by way of the shaft, and we should *a priori* expect to find that the resistance would be least right down the shaft. It might spread out a very short distance on the barbs, but the main tendency would be toward the tip." Again he says (p. 177): "It is evident that along the line of demarcation

of two colors the pigments are apt to get confused as to which is their proper route, and hence both come upon the same feather [in 'hybrid' feathers] by accident, as it were." Is it possible that Mr. Keeler is unaware that the tip of the feather forms first, and receives its pigment and markings, whatever they may be, before the middle and lower parts of the feather have passed beyond the gelatinous stage of the as yet not fully developed feather? This being the case it is needless to discuss "lines of least resistance" and "the development of pigment in mass when an obstacle is encountered," as illustrated by our author in the unhappy simile of a "panic-stricken mob"! Neither is it necessary to consider the various classifications and generalizations based on this erroneous departure,¹ that fill so many of the subsequent pages. Alas, the fewer facts for a nicely spun theory the better!

At page 181 he gives a list of markings not known to him to occur among birds; but if he had broadened his survey to other regions of the world he would have had no trouble in finding nearly all of them. Even our own Woodcock would have given him an example of "the top of the head barred," while numerous species of Old World Cuckoos and Kingfishers would have furnished still finer illustrations. And so on with most of the other unknown markings.

As one example, out of many, of slipshod generalization take the following from p. 196: "I would suggest that there is great probability that the habits of birds have been more or less determined by their colors"; as for example, in a group of olive green or gray birds "those which formed the habit of living in trees would survive, while those frequenting the ground, being more conspicuous, would perish," as would in like manner "brown birds which got up among trees" instead of remaining on the ground! The very next bird mentioned (p. 197) is the Brown Creeper, which has developed a "special protective resemblance" to the bark of trees.

¹ Even the most rudimentary knowledge of the method of feather growth, such for instance as could be gained from Burmeister's note on the subject in Nitzsch's 'Pterylographie,' would have saved our author this humiliating mistake. Also if his general knowledge of feather structure had been a little more extended he would have saved himself the trouble of describing as 'A Supposed New Feather Structure' (Zoe, III, Oct. 1892, p. 257), the simple thread-like form of feather known since the time of Nitzsch as the *filopluma*, and mentioned in so readily accessible a work as Coues's 'Key to North American Birds' (p. 186). These filoplumes are present probably in all birds, and over large portions of the feathered tracts, instead of possibly proving, as Mr. Keeler suggests, "to be a generic character" in our Orioles. An inspection of plucked fowls in markets will furnish an instructive illustration of the general character of filoplumes, for which Mr. Keeler has so recently proposed the name *Pseudopilum*. In this connection we will venture to suggest that had our author devoted some time to a general study of pteryæ in connection with special color areas he would have been rewarded by the discovery of many suggestive coincidences, and also that use of the microscope would have thrown much light upon the general subject of feather structure in its relation to coloration.

There is a large amount of nonsense, sparingly mixed with a few good suggestions, on the subject of 'Recognition Marks' and allied topics, for which our author is responsible only so far as to follow the hasty suggestions of various predecessors and of adding more of like character. "With the Crows and Blackbirds," he says (p. 203), "which habitually consort in flocks, it is quite possible that means of recognition has been at least one factor in the production of black color." But it happens that Crows and Blackbirds (*i.e.*, Icteridæ) are not the only black birds in the world, which occur in a great number of families in various countries; nor are they all gregarious, nor are more than a small part of the gregarious birds black. It is apparently more than hinted (p. 152) that the concealed white color on the neck feathers of *Corvus cryptoleucus* may be due to a tendency to albinism, which "is common among Crows"! Does this statement coincide with the facts in the case, in comparing Crows with Thrushes, or with Sparrows, for example, or with birds in general?

"In the Passenger Pigeon (*Ectopistes migratorius*) the tail markings are highly complex. . . . The necessity for directive recognition marks would be especially necessary in a species moving in such large flocks, from which individuals or small parties would constantly get astray. It may be that the complex pattern on the tail feathers was evolved first as a discriminative mark, for except in size, the species might easily have been confused with the Mourning Dove (*Zenaidura macroura*) which has the tail marked with a simple irregular subterminal band of dusky" (p. 205). Did our author stop to reflect to what extent these "highly complex" tail marks are visible, or to what extent they would aid as recognition marks in comparison with the Pigeons highly distinctive call-note, or in what way they could possibly serve as "directive recognition marks" to stragglers that had wandered from the flock? These "highly complex" tail markings are found only at the extreme base of the tail, within the area normally concealed by the coverts, and are therefore not visible under any ordinary conditions. Hence we wonder whether Mr. Keeler took the trouble to examine even a museum specimen of the bird, or whether he depended upon the description which he copies from Mr. Ridgway's 'Manual,' which does not happen to state the particular portion of the tail thus marked. These are but a sample of the author's methods of reasoning and far-fetched theories. There is also evidence of much haste or carelessness in the preparation of many parts of the work, including slips in nomenclature, and contradictory statements or conflicting generalizations, sometimes following each other on almost consecutive pages.

While there is much that is valuable in the book, and many points that are well taken, Part II especially is largely vitiated by unsound reasoning, by misapprehension of facts, or by lack of general information on special points. It is very easy to speculate and surmise, even to the extent of giving the reader either one of several hypotheses, all perhaps equally worthless, for the explanation of a given fact, — easier perhaps than to

confess ignorance, which is after all what the whole proceeding plainly shows.

Plate IV furnishes a very striking and interesting illustration of head-markings, with arrows arranged to show how one form of marking may have been derived from another, and how all may be reduced to five general types. As, however, the birds representing the successive stages of modification belong usually to distantly related genera, or even families, and as the relationships, as our author says in the text (p. 187) "are not supposed to be genetic," it may be asked, Of what practical utility is this elaborate generalization? Or what light does it throw upon the real method of evolution of these various patterns?

Great stress is laid upon the "primitive streaked plumage," and upon the streaked feather as a primitive type. While this may be true in a restricted sense, and form a test of grade in a group of closely allied species, it fails when taken in a general sense, as for instance in comparing Pigeons and Tinamous (genus *Tinamus*) as groups with Thrushes and Sparrows, or many 'low' groups with higher ones.

While Mr. Keeler's book is highly original in both conception and execution, and exceedingly novel and interesting in its pictorial illustrations, it displays, we are pained to say, much misdirected energy; and unless the lay reader and the novice keep in mind the opening paragraph of the preface, they are liable to acquire a large amount of misinformation.—J. A. A.

Beddard's 'Animal Coloration.'¹—The present volume, says the author, is addressed to persons having no special knowledge of zoölogy, and its aim is "to furnish a general notion of the facts and theories relating to Animal Coloration." "It contains hardly anything novel, but professes to give some account of the principal phenomena of coloration exhibited by animals." It is thus mainly a review of previous theories and the facts on which they are based, with a running critical commentary representing the views of the author respecting the many disputed points at issue. It consists of six chapters, having the following headings: I. 'Introductory.—The Principal Facts of Animal Coloration' (pp. 1-41); II. 'Coloration affected by the Environment' (pp. 42-82); III. 'Protective Coloration' (pp. 83-147); IV. 'Warning Coloration' (pp. 148-192); V. 'Protective Mimicry' (pp. 193-252); VI. 'Sexual Coloration' (pp. 253-282).

Mr. Beddard distinguishes 'Colour' from 'Coloration,' the former relating to the actual tints, the latter to the arrangement or pattern of these tints. Colors are due either solely to the presence of definite pigments,

¹ Animal Coloration | an Account of | The Principal Facts and Theories | relating to the | Colors and Markings of Animals. | By | Frank E. Beddard, M. A. Oxon., F. R. S. E., etc., | Prosecutor to the Zoological Society of London, Lecturer on Biology at Guy's Hospital | With Four Colored Plates; and Woodcuts in the Text | [Monogram] London: Swan, Sonnenschein & Co. | New York: Macmillan & Co. | 1892. —8vo, pp. viii, 288.

or in part to optical effects, due to mechanical structure, as in the case of iridescent feathers, scales, etc., by which the light rays are scattered, diffracted, or unequally refracted; in such cases, however, a background of dark pigment is necessary for the display of the metallic lustre. A variety of pigments has been found and chemically analysed, by which it is found that the same color, even in allied forms, is not always due to the same pigment. "The brown colour of birds is chiefly due not to one pigment, but to two apparently distinct pigments, which give different chemical reactions." The green color of the Turacou is due to an entirely different pigment from that which causes the green color in Parrots. Thus the same effect is often produced by quite different pigments. Again, differently colored animals have the same pigment, as in the case of the very differently colored sexes in the Parrots of the genus *Eclectus*, the color difference being due to a difference in the structure of the feathers, the males in these Parrots being colored green and the females red.

Color is believed to be "a normal product of organization, entirely independent of utility"; yet there is good evidence that "coloration" bears often a distinct relation to the needs of the animal," and may therefore be modified by 'natural selection,' using this term in its broadest sense. On the other hand, it is quite evident that coloration is not always in harmony with the mode of life of the animal, while often 'complex markings' are so placed as to be of no possible use to the animal possessing them. It is hence frequently impossible to advance any reasonable hypothesis to account for their presence. Hence Mr. Beddard freely admits that the "action of natural selection" in producing color changes is limited. He also calls attention to the comparative constancy of color and color markings throughout whole genera and even families, and also that the same plan of coloration is often repeated in very distantly related groups. This fact is sometimes explained on the ground of mimicry, but in many cases such an explanation is beyond supposition.

In some instances there is apparently some relation between coloration and structure of the underlying parts of the organism, but the cases where this is obvious, or where some better explanation may not be suggested, are very few: the agreement is, we believe, more a matter of chance coincidence than one of any deeper relation.

In discussing changes of color during the lifetime of the individual, Mr. Beddard points out various flaws in the reasoning of Weismann and Poulton on the subject, but leaves much unsaid that may be urged in opposition to their views. Lack of space, however, forbids entering upon the subject in this connection.

Mr. Beddard, we are glad to see, is willing to grant that the influence of an animal's surroundings may exercise a direct influence upon its coloration without the intervention of the agency of 'natural selection.' Under this head are very properly considered the seasonal changes of many Arctic animals.

The subject of 'Protective Coloration' is discussed at considerable length, and for the most part with commendable conservatism, in comparison with the credulous spirit in which the subject is often handled. Many previously alleged cases of protective coloration are considered as not proven, or as *sub judice*, or as more satisfactorily explainable in other ways. Furthermore, he does not consider that protective resemblances between animals and their surroundings have all been produced by natural selection, citing many instances in which the assimilation of color to the natural surroundings is pretty obviously due to food,—as notably among the various marine animals which feed upon the brightly colored sea weeds among which they live. He says (p. 132): "Considering the resistant nature of many pigmentary substances, vegetable as well as animal, it is at least probable that a large number of cases of color resemblance, often set down to the action of natural selection, may be due, as in the case of *Ennace*, to the simple excretion by the skin of these pigments which have been taken in as food. Until more is known about the chemical composition of animal pigments, *it would be rash to adopt an elaborate explanation when the more simple one would be sufficient.*" If the course recommended in the passage we have italicised in the above quotation were generally followed in similar cases, much worthless speculation would be saved, greatly to the advantage of real scientific progress. Again Mr. Beddard observes: "At every step, in fact, in the study of animal coloration, we are met with closed doors, which can only be unlocked by keys furnished by an intimate chemical and physiological knowledge such as we do not at present possess" (p. 140).

The subject of 'Warning Colors' is discussed at considerable length and with great candor. Here Mr. Beddard's remark that "The field of hypotheses has no limits," and that what we need is "more study," applies with special force. After reviewing the evidence, pro and con, he appears to arrive at the conclusion that 'warning colors,' particularly in insects and the lower forms of life generally, have not been evolved for the express purpose of warning, but rather that they are concomitant with inedibility—"that the brilliant colors (*i. e.*, the abundant secretion of pigment) have caused the inedibility of the species, rather than that the inedibility has necessitated the production of bright color as an advertisement" (p. 173). The theory of warning colors is, of course, that they have been especially evolved to give notice of some disagreeable quality. The skunk (genus *Mephitis*) has come to be a classic illustration of the theory. But Mr. Beddard points out that in South America skunks are not free from enemies, being the prey, and sometimes the chief food, of many rapacious birds; and those readers of 'The Auk' who have had much acquaintance with our Great Horned Owl can give corroborative testimony in respect to those of North America.

Closely related to the theory of 'warning colors' is that of 'Protective Mimicry,' to which it is supposed to furnish support. This theory origi-

nated with Mr. H. W. Bates, the well-known English naturalist who spent so many years on the Amazon in South America. It was suggested by his finding that a certain group of butterflies (*Heliconidæ*), conspicuously banded with yellow and black, were provided with certain glands which secrete a nauseating fluid, supposed to render them unpalatable to birds. In the same situations were also found similarly colored butterflies belonging to another family (*Pieridæ*), which so closely resembled the others in shape and markings as to be easily mistaken for them, but which were unprovided with the scent-secreting glands, and were thus unprotected from attacks from birds. This resemblance it was thought was brought about by natural selection for the protection of the edible butterflies through the birds mistaking them for the inedible kind. Other cases of mimicry among a great variety of insects have since been pointed out, and the theory of protective mimicry has secured many adherents. A close scrutiny of these alleged cases, however, shows that in many instances, and to a considerable extent, 'protection fails to protect.' Mr. Beddard gives the evidence in favor of mimicry at some length, interspersed with some rebutting comment, and then discusses the objections to the theory. The discussion is too long to be followed here, and the objections too numerous even for recapitulation. One is that resemblances occur between animals inhabiting widely separated areas which are so close that if the same forms were found together one would be considered as a case of mimicry of the other. Again resemblances occur between distantly related forms found in the same country in which neither has any special means of protection, and hence the 'mimicry' is without any protective effect. Again, cases occur where the resemblance is a positive disadvantage to the mimicker. Many special cases, as of flies mimicking bees, spiders mimicking ants, etc., are dealt with separately, and the objections in each case seem fairly conclusive. In commenting upon the rarity of even alleged cases of mimicry among mammals, Mr. Beddard considers that this fact is not remarkable, when we consider how few the total number of mammals is when compared with insects, and that out of the vast assemblage of the latter "it would be strange if there were not many cases of accidental resemblance; and there are many such" (p. 237).

In 'Chapter VI. Sexual Coloration,' Mr. Beddard appears to wholly reject Mr. Darwin's much admired theory of 'Sexual Selection,' and quotes at length Mr. Wallace's *reductio ad absurdum*, which, as illustrating the view of an ultra natural selectionist, may well be here transcribed: "Natural selection . . . acts perpetually and on an enormous scale in weeding out the 'unfit' at every stage of existence, and preserving only those which are in all respects the very best. . . . Now this extremely rigid action of natural selection must render any attempt to select mere ornament utterly nugatory, unless the most ornamented always coincide with 'the fittest' in every other respect; while if they do so coincide, then any selection of ornament is altogether superfluous. If the most brightly coloured and fullest plumaged males are *not* the most healthy and vig-

orous, have *not* the best instincts for the proper construction and concealment of the nest, and for the care and protection of the young, they are certainly not the fittest, and will not survive, or be the parents of survivors. If, on the other hand, there *is* generally this correlation — if, as has been here argued, ornament is the natural product and direct outcome of superabundant health and vigour, then no other mode of selection is needed to account for the presence of such ornament. The action of natural selection does not indeed disprove the existence of female selection of ornament as ornament, but it renders it entirely ineffective; and as the direct evidence for any such female selection is almost *nil*, while the objections to it are certainly weighty, there can be no longer any reason for upholding a theory which was provisionally useful in calling attention to a most curious and suggestive body of facts, but which is now no longer tenable.”¹

Mr. Beddard adds: “In short, we find that the secondary sexual characters of animals are dependent upon the germ glands themselves; and that the sexual diversity of animals is also associated with differences of disposition and habit. There is a fundamental difference between males and females, based upon the actual difference of sex, which generally finds an expression in outward unlikeness. These superficial differences may also be partly due to the different mode of life led by the two sexes. We meet with them in animals which cannot be moved by choice or æsthetic preference; but it is also true that they are most highly developed in the higher animals, where such choice is at least conceivable; the mammal, however, forms a very important exception to this statement” (p. 282).

A fine vein of irony occasionally appears in Mr. Beddard's comments upon alleged cases of mimicry, and especially of alleged instances of sexual selection, as in respect to the mating and ‘love dances’ of spiders. But on the whole his criticisms are suggestive rather than aggressive.

We have long been of the opinion that most of the cases of supposed ‘warning colors,’ of mimicry, and sexual selection were to be much more satisfactorily accounted for on other grounds than by the special theories that have of late proved so popular with superficial writers, and apparently so fascinating to the still less discerning public, and we are glad to welcome so healthy an antidote to this mild phase of scientific lunacy as Mr. Beddard's book on ‘Animal Coloration.’ — J. A. A.

Our Hawks and Owls in their Relation to Agriculture. — ‘Bulletin No. 3’ of the Ornithological Division of the U. S. Department of Agriculture,²

¹ Wallace, *Darwinism*, p. 295.

² The Hawks and Owls of the United States in their Relation to Agriculture. Prepared under the Direction of Dr. C. Hart Merriam, Ornithologist, by A. K. Fisher M.D., Assistant Ornithologist. Published by Authority of the Secretary of Agriculture. Washington: Government Printing Office, 1893.—8vo, pp. 210, with 26 colored plates — U. S. Department of Agriculture, Division of Ornithology and Mammalogy, Bulletin No. 3.

prepared under the direction of Dr. C. Hart Merriam, Chief of the Division, by Dr. A. K. Fisher, Assistant Ornithologist, is devoted to "a report on the Hawks and Owls of the United States, with special reference to the economic status of the various species." To quote from Dr. Merriam's letter of transmittal: "The statements herein contained respecting the food of the various hawks and owls are based on the critical examination, by scientific experts, of the actual contents of about 2700 stomachs of these birds, and consequently may be fairly regarded as a truthful showing of the normal food of each species. The result proves that a class of birds commonly looked upon as enemies to the farmer, and indiscriminately destroyed whenever occasion offers, really rank among his best friends, and with few exceptions should be preserved and encouraged to take up their abode in the neighborhood of his home. Only six of the 73 species and subspecies of hawks and owls of the United States are injurious. Of these, three are so extremely rare they need hardly be considered, and another (the Fish Hawk) is only indirectly injurious, leaving but two (the Sharp-shinned and Cooper's Hawks) that really need be taken into account as enemies to agriculture. Omitting the six species that feed largely on poultry and game, 2212 stomachs were examined, of which 56 per cent. contained mice and other small mammals, 27 per cent. insects, and only 34 per cent. poultry or game birds." "In view of these facts," adds Dr. Merriam, "the folly of offering bounties for the destruction of hawks and owls, as has been done by several States, becomes apparent, and the importance of an accurate knowledge of the economic status of our common birds and mammals is overwhelmingly demonstrated."

Dr. Fisher, in his introduction, recounts these generalizations more in detail, and adds: "One of the counties of Pennsylvania paid out in a year over \$5000 for scalps of birds of prey. . . . There is no doubt that this State and others which have passed similar laws have made a serious mistake; for it is indisputable that the opinion about hawks and owls, so widespread and popular, is not well founded; and it is the purpose of this bulletin to set forth the results of many years' observations with the view of dispelling the popular illusion regarding the destructiveness of hawks and owls as a class." He adds that "Owls are among the most beneficial of birds, inflicting very little damage upon the poulterer and conferring vast benefits upon the farmer"; and that "all Hawks, with possibly one or two exceptions, are to some extent beneficial to the farmer."

The various species of rapacious birds are divided into four classes: (1) Those wholly beneficial or wholly harmless. These number six species: Rough-legged Hawk, Squirrel Hawk, Swallow-tailed Kite, White-tailed Kite, Mississippi Kite, and Everglade Kite. (2) Those chiefly beneficial. These include the greater number of the most widely dispersed and best known species of both Hawks and Owls. (3) Those in which the beneficial and harmful qualities seem to balance each other. In this class some species may be beneficial in one part of the country and injuri-

ous in another, as the Great Horned Owl, etc., which in the East preys upon game and poultry, and in parts of the West is highly useful in destroying the superabundant hares and other rodent pests. (4) Those positively harmful, as the two species of Hawks already named, and the Goshawk, Duck Hawk, and Gyrfalcons. The Fish Hawk also comes into this category as it "eats fish, and fish only, and is often a nuisance to the fish culturist. . . . If its fine presence and magnificent flight do not sufficiently plead in its favor, then it must be put on the black list."

The species and subspecies are each taken up in detail, their habitats stated, their food habits explained, followed by a brief description of the species, with a table showing the results of the examination of stomachs. A very good colored plate is given of all the more important or prominent species, thus affording easy means of identification to the farmer or others interested. As a sort of badge of character, the various species are represented as holding in their talons or beaks specimens of their characteristic food, as reptiles, insects, mice, spermophiles, squirrels, birds or poultry, as the case may be. The plates were drawn by Mr. J. L. Ridgway, and their reproduction has been effected with varying degrees of success, some of them being excellent and others far from faultless, either in coloration or artistic effect.

From an economic standpoint this long-expected report should be of the highest importance, and should do much to enlighten not only the farmers but the public at large that a bird is not necessarily to be black-listed and hunted to extermination simply because he is clothed in the garb of a hawk or an owl. It will, however, take much reiteration and intelligent missionary work to allay the unreasoning prejudice against hawks and owls, which from time immemorial has everywhere been inculcated, because, forsooth, there are a few black-legs in the guild. The utility of systematic research concerning economic problems in natural history by experts under government auspices is again abundantly demonstrated in this valuable report upon a long misunderstood but important subject, the relation of birds of prey to agriculture.—J. A. A.

Bolles's 'Chronicles.'—Mr. Bolles's 'At the North of Bearcamp Water'¹ is a companion volume to his 'Land of the Lingering Snow' (see Auk, IX, p. 62), being the second volume of the 'Chronicles of a Stroller,' this time in the New Hampshire highlands. The book, like its predecessor, is very little given to moralizing about what the author sees, and is perhaps for this all the more novel and refreshing. From the naturalists' standpoint Mr. Bolles's record is not less graphic and minute, and quite as readable and more 'scientifically' accurate than the volumes which have

¹ At the North of Bearcamp | Water | Chronicles of a Stroller in | New England | from July to December. | By | Frank Bolles | author of "Land of the Lingering Snow" | [Vignette] | Boston and New York. | Houghton, Mifflin and Company. | The Riverside Press, Cambridge | 1893. 12mo. pp. 297.

made Thoreau such a favorite with many readers, though perhaps less fascinating to sentimental admirers of nature. In fact, the two authors hold little in common, beyond love of mountain, field and woodland, and their non-human denizens.

Mr. Bolles is sometimes a little abrupt in his transitions—perhaps studiously so—and his sentences are frequently short and jerky, but his language is concise and graphic, and his style generally crisp and pleasing. His frequent allusions to birds and mammals show that he has had either good coaching or is himself a naturalist, at home in the technique of science, and in the use of traps and the gun, as well as the field-glass, as is so well shown in the chapter entitled 'Trapping Gnomes.' Nearly all of the twenty-one articles that make up the book contain passing allusions to birds, botany and mammals, while several of them are distinctively ornithological, as, for instance, 'The Dead Tree's Day' and 'Migration'; while 'Chocorua in November,' 'Among the Wind-swept Lakes,' and 'In the Paugus Woods,' etc., give glimpses of the late autumn and winter bird life of a region an ornithologist rarely sees at these bleak seasons.—J. A. A.

Foster's Bibliography of the Ornithological Writings of George N. Lawrence.¹—Mr. Foster has done ornithologists an excellent service in his carefully prepared and exceedingly detailed bibliography of the writings of Mr. George N. Lawrence. It is prepared on the same plan as Professor Goode's bibliography of the writings of the late Professor Baird, which forms No. 1 of this series of bibliographies. A short biographical sketch of Mr. Lawrence precedes the list of his works, and an excellent portrait of him forms the frontispiece of the brochure. Mr. Lawrence's first formal paper was published in 1846, describing a new species of Brant (*Bernicla nigricans*); the last here noted appeared in January, 1891. The total number of titles is 121. His writings relate mostly to the birds of the West Indies, Mexico, Central and South America. The titles are arranged chronologically, and besides the full title and place of publication a synopsis of each paper is presented so far as to give in tabular form the names of the species mentioned, the locality cited when not sufficiently implied in the title of the paper, and the page where mention of the species is made. The chronological list is followed by an alphabetical list of the new species and subspecies, giving the habitat of the type specimen, and a cross-reference to the chronological list. These number 323! An alphabetical general index follows, which, with the chronological list, enables one readily to find any species ever mentioned by Mr. Lawrence in his writings. Pages ix to xi contain a list of the 19 species, and the single genus of birds named in honor of Mr. Lawrence.

This bibliography well attests the great activity of Mr. Lawrence in ornithological work during a period of nearly half a century.—J. A. A.

¹ Bulletin of the United States National Museum. No. 40. Bibliographies of American Naturalists: IV. The Published Writings of George Newbold Lawrence, 1844-1891. By L. S. Foster. Washington: Government Printing Office, 1892. 8vo, pp. xi, 124, frontispiece, portrait of Mr. Lawrence.

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GENERAL NOTES.

Alle alle in Virginia.—In a recent letter Captain Crumb of Cobb's Island, Virginia, informs me that a Dovekie (*Alle alle*) was taken there this winter, this being its second known occurrence at that place.—EDWARD J. BROWN, *Washington, D. C.*

The American Woodcock (*Philohela minor*) in Great Numbers at Mount Pleasant, South Carolina.—A cold wave accompanied by a gale struck the coast of South Carolina on the morning of December 27, 1892. There was plenty of snow, ice and sleet on the ground the whole day. In fact the weather moderated very little the whole week. The thermometer registered as low as 18° to 22° during the week.

On the morning of December 27 thousands of Woodcock were shot in the village of Mount Pleasant. They were everywhere—in the yards, stables, streets, and even piazzas. Everybody was out after the birds, and every one had a bag full to overflowing. On that day alone fully two thousand were killed. On December 28 they were so abundant that every clump of bushes contained from ten to fifteen birds. One man killed fifty-eight without moving from his 'stand' except to pick up the birds he killed.

The flight lasted six days, and during that time it would be safe to put the number of Woodcock killed and seen at ten thousand. The markets were overstocked, and they could be bought for twenty-five cents a pair, when normally they sell for seventy-five cents.—ARTHUR T. WAYNE, *Mount Pleasant, South Carolina.*

Gambel's Partridge at San Bernardino, California.—On January 15, 1893, Mr. J. S. Bright sent me a male Gambel's Partridge (*Callipepla gambeli*) which he killed near here. This is, I believe, the first capture of this species here, though it is found at Whitewater, sixty miles distant. The bird was in very poor flesh, but in good plumage.—EDWARD WALL, *San Bernardino, California.*

Antrostomus vociferus in South Carolina in Winter.—An adult male Whippoorwill was brought to me on January 6, 1893, that had been caught in a small steel trap. The trap was set by a lad purposely for this bird, as I had offered him a reward. It was caught by one foot.

The fact that this bird was taken during the coldest weather that South Carolina ever experienced for more than forty years makes it probable that this bird winters regularly in this locality.—ARTHUR T. WAYNE, *Mount Pleasant, South Carolina.*

The Horned Lark (*Otocoris alpestris*) near Charleston, South Carolina.—On January 18, 1893, there was a fall of snow. This is a remarkable occurrence for the coast region of South Carolina. The weather was bitterly cold during the following seven days, when it moderated.

I was afield early every morning, and I was well repaid on the morning of the 20th, when I discovered three Horned Larks soaring very high. Finally one alighted in a corn field, when it was promptly shot.

The same day I discovered a flock of about fifteen, which were feeding in an old field. I secured two, on the ground, and two while they were flying, making five taken in all.

I failed to find the birds after they flew away, although I searched every field carefully for miles in every direction. No more were seen on the following days.

As far as I am aware this is the first record for the seaboard of South Carolina, and the most southerly record of its occurrence. To make sure of the form I sent a specimen to Mr. William Brewster, and he has pronounced it true *alpestris*.—ARTHUR T. WAYNE, *Mount Pleasant, South Carolina.*

Acanthis linaria in Alabama.—In September, 1874, a male Redpoll was shot by the writer near Stevenson, Alabama. I can find no other record for this species south of latitude 35°, and, judging from my own observations in Tennessee and northern Georgia, this is a very rare bird in either of the above-named States.—F. T. PARK, *Warner, Hickman Co., Tennessee.*

The Field Sparrow Wintering in Massachusetts.—On the 19th of December, 1892, I found a Field Sparrow (*Spizella pusilla*) in Wellesley, Massachusetts, and three weeks later, January 8, saw it again in the same place—a sheltered and sunny nook, with a weedy garden patch and plenty of thick evergreens. My only previous meeting with this Sparrow during the winter months was in Wakefield, Mass., December 21, 1890.—BRADFORD TORREY, *Wellesley Hills, Mass.*

Junco ridgwayi in Colorado.—While collecting near Boulder, Colorado, Nov. 25, 1892, I secured a specimen of *Junco ridgwayi* Mearns. The pink of the sides is not so extensive as in specimens of *Junco annectens* in

my collection. The color is quite as deep, however. Measurements (in millimetres): wing, 84; tail, 77.5; bill from nostril, 8.5; tarsus, 19.5. To place the bird's identity beyond dispute I sent it to Mr. Robert Ridgway, who writes me as follows:—

"I have carefully compared your *Junco* with our specimens of '*J. ridgwayi*,' and find that it is, essentially, the same bird. Our specimens, however, are in breeding dress (they are adult male and female, obtained at Ft. Bridger, 'Utah,'—now Wyoming,—May 20, 1858), and consequently are hardly comparable. Still, there is no more difference between your bird, which is an autumnal male, and the Ft. Bridger male than there is between fall and spring specimens of *J. annectens*, *J. caniceps*, or the other species of the genus.

"I still have doubts as to the validity of this bird as a species or even as a permanent race, on account of the circumstance that its characters are an exact combination of those of *J. annectens* and *J. caniceps*. In other words, it may be regarded either as a *J. caniceps* with pink sides or a *J. annectens* with 'red' back."

The bird was found among the willows on Boulder Creek, associated with *J. annectens*, *caniceps*, *aikeni*, and *shufeldti*. Boulder is directly at the base of the foothills, where numerous Juncos may often be found when not one can be discovered away from the sheltering hills.—R. C. MCGREGOR, *Denver, Colorado*.

Unusual Habits of Lincoln's Sparrow.—While collecting Warblers from the top of an elm tree May 23, 1892, I shot two Lincoln's Sparrows, one male and one female. Their manner of feeding and hopping about the branches so closely resembled the Warblers with which they were associated that I could scarcely distinguish one from the other. As this species is of retiring habits and supposed to be confined to low bushes and thickets, I consider this worthy of note.—WILLARD E. TREAT, *East Hartford, Connecticut*.

Wintering of *Regulus calendula* at Washington, D. C.—On December 5, 1892, I saw and positively identified a single Ruby-crowned Kinglet in the grounds of the Department of Agriculture, and also saw what was presumably the same individual on January 5, 6, and 14, this period covering some of the most severe weather ever known here. This is the first record for the District of the species wintering.—W. E. CLYDE TODD, *Washington, D. C.*

Notes on Some Connecticut Birds.—*Hydrochelidon nigra surinamensis*.—A young bird of this species was killed here August 29, 1892, and is in my collection. There were four of them together, but the others could not be obtained. The previous records for the State are two specimens shot at Goose Island and Milford (*Merriam*, *Rev. Bds. Conn.*, 1877, 135).

Fulica americana.—Although not an uncommon migrant, especially in autumn, this familiar bird was particularly abundant here from September 29 to November 14, 1892.

Aquila chrysaëtos.—A specimen of this Eagle was taken at Essex, some twenty miles south of Portland, Nov. 1, 1892, and is in my cabinet. It was captured alive.

Falco sparverius.—The Sparrow Hawk, always considered a rare resident in this vicinity, was found in unusual numbers during the winter of 1892-93. They could be seen nearly every day. On the 4th of February I saw one in Hartford considerate enough to capture an English Sparrow.

Strix pratincola.—A female Barn Owl was shot at Leesville, a dozen miles south of this place, June 11, 1891, and brought to me alive. This is the first instance known of the bird's occurrence in this vicinity. Six are on record from different sections of the State.

Asio wilsonianus.—In many years' collecting in this vicinity I have never known the Long-eared Owl so numerous as during the autumn of 1892. They were apparently migrating from the first week in October until early in December.

Coccothraustes vespertinus.—Recently, when examining the collection of birds made by Mr. H. E. Rich, of East Hampton, Conn. (nine miles east of Portland), I saw an adult male of the Evening Grosbeak which was killed in that vicinity March 2, 1890. Mr. Rich informed me that there were twelve or fourteen in the flock, and that several Pine Grosbeaks were with them. The other Evening Grosbeaks reported from this State were taken at Portland, March 6, and Gaylordsville, March 10, of the same year, during the remarkable irruption of the species at that time. ('Forest and Stream,' XXXIV, March 27, 1890, 187;—Auk, VII, April, 1890, 211.)

Melospiza lincolni.—A male of this rare Sparrow, now in my collection, was shot here September 21, 1892, by Mr. W. E. Treat.

Zonotrichia leucophrys.—These migrating Sparrows were abundant here on the 12th of October, 1892. I have never known them to visit us in such numbers before.

Sitta canadensis.—An unusual flight of the Red-breasted Nuthatch was observed here from Sept. 27 to Oct. 23, 1892, the height of the migration being about the middle of October. They were quite common in other sections of the State during the same period. —JNO. H. SAGE, *Portland, Conn.*

Winter Birds in Connecticut.—On Dec. 15, 1892, I had a fine specimen of *Rallus elegans* brought to me in the flesh to be mounted. The bird is a male in fine plumage and was shot on the salt marshes at Milford, Connecticut, about nine miles from here. On Jan. 18, 1893, a freshly killed specimen of the Rose-breasted Grosbeak was brought in. The bird was shot at Southington in the central part of the State, and was a male, and was apparently in good condition. While skinning it I discovered that the

left tibia had been broken and healed again quite recently. The plumage was that of the young male as found here during the spring migrations. On January 19 I purchased a fine male of the Great Gray Owl from a farmer who had shot it the day before at North Haven. The Owl was still alive.—A. H. VERRILL, *New Haven, Connecticut*.

Notes on *Helminthophila chrysoptera*, *pinus*, *leucobronchialis* and *lawrencei* in Connecticut.—The brief notes herein given are from Portland, a locality which seems a favorite resort for these interesting and perplexing Warblers.

Helminthophila chrysoptera is a not uncommon summer resident, arriving as early as the 8th of May and frequenting dense swamps and swampy woodland. It is partial to hickory, oak and buttonwood trees, and when migrating in the spring may be found on high scrubby ground and in old pastures and orchards. The past season (1892) a male was captured in my door-yard—an unusual place, as it is not the custom of this Warbler to visit the thickly settled portions of the village.

To hunt this bird successfully it is necessary to become familiar with the odd song. Did it not in this manner reveal its identity, it would be almost impossible to find it when perched among the young leaves on a buttonwood or hickory tree.

My series of skins of this species, taken here during the past eighteen years, shows many odd variations.

A nest containing four fresh eggs was taken June 4, 1892. It was on the ground in a swampy spot and under a skunk cabbage (*Symplocarpus foetidus*). The eggs are pure white, evidently an abnormal set. The female was secured as she flew from the nest. The male was also seen. It had the typical black throat. I believe the eggs of this Warbler have not been recorded from the State before.

In other sections of Connecticut *H. chrysoptera* is considered rare. At Saybrook, New Haven, Bridgeport and Seymour they are seldom seen. Mr. Willard E. Treat, an experienced collector living at East Hartford, Conn., (fifteen miles north of this place) tells me that he has never found there any of the Warblers mentioned in this article.

The interbreeding of *chrysoptera* and *pinus*, at Portland, was noted in 'The Auk' (Vol. VI, July, 1889).

Helminthophila pinus comes to us the first week in May, and is a regular, but rare, summer resident. While here it does not wander far from a swampy spot grown up with alders, a few maples and an occasional oak and elm. A nest with four eggs, and one of *Molothrus ater*, was taken May 31, 1887.

Mr. Brewster's long-named Warbler, *Helminthophila leucobronchialis*, would seem to be a regular summer visitant, as we have taken it now for seven successive years. It appears by May 10, and is in full song until the middle of June.

Continued experience leads me to think that the song of this puzzling bird is not, as has been stated, any criterion by which to distinguish it. Sometimes they sing *exactly* like *chrysoptera*, again like *pinus*, and often have notes peculiar to themselves. A trained ear may find the bird, but it needs the eye to properly identify it.

At the present writing I am not inclined to believe *leucobronchialis* a hybrid, but hope to have more to say on this subject at another time.

One example only of *H. lawrencei* has been taken, a male, May 14, 1887. The yellow below is not as bright as in some specimens that I have seen from New Haven and Stamford.

All of the Warblers referred to inhabit similar ground, and, with the exception of *lawrencei*, are occasionally taken the same day. It is safe to say that *chrysoptera* is common here, then in order of abundance come *leucobronchialis* and *pinus*, *lawrencei* being extremely rare.—JNO. H. SAGE, Portland, Conn.

Correction.—On page 90 of the January 'Auk,' under *Helminthophila celata*, it should be stated that the records quoted are not all there are from the Eastern States, but merely those from the near vicinity of Long Island. Under *Turdus aliciae bicknelli*, the statement that "I shot two Bicknell's Thrushes on Oct. 5, 1892," is incorrect. The only birds I ever secured on Long Island were those referred to in the second clause as killed in 1889, and the remarks in the first clause refer to those also.—ARTHUR H. HOWELL, Brooklyn, New York.

The Occurrence in Summer of Certain Warblers at Beaver, Pennsylvania.—The following notes are presented as supplementary to those published in 'The Auk,' Vol. VIII, 1891, pp. 397-399.

Helminthophila pinus.—A single individual was observed June 16, 1892, making the third record for this locality.

Geothlypis formosa.—This bird, which I have previously recorded as a rare summer resident, I found to be fairly abundant, in suitable situations, throughout the season of 1891, as well as during the week from June 13 to 18, 1892, inclusive, which I spent there, so that it seems not improbable that it was overlooked in previous seasons. Towards the close of May, 1891, I discovered a nest, containing one egg, but it was soon afterward invaded by a Cowbird, and deserted. Young out of the nest were found during my visit in 1892.

Sylvania mitrata.—On June 17, 1892, I found a pair feeding their young which had just left the nest. This was at the precise spot where the species had been repeatedly observed during September of both 1890 and 1891.—W. E. CLYDE TODD, Washington, D. C.

CORRESPONDENCE.

[Correspondents are requested to write briefly and to the point. No attention will be paid to anonymous communications.]

"A Neglected Branch of Ornithology."

TO THE EDITORS OF THE AUK:—

Dear Sirs: Chief among the reasons, so it seems to the writer, why our younger ornithologists neglect not only the pterylography of birds, but many other equally important branches of ornithology, are the time, care, and patience needed for the prosecution of such work, the labor required for the accumulation of facts, and the difficulty of properly publishing results.

Most workers, especially the younger ones, like to behold the fruits of their labors, and most of them, too, like to see some of these fruits dished up in type. The easiest and quickest means for the accomplishment of these desires is first to 'make a collection' and secondly to publish a 'local list,' and to these ends most of our rising ornithologists devote themselves. Not that this is much to be wondered at, for the work of collecting is pleasant, and the seeking of feathered prizes by wood and stream has a charm about it that few can find in pottering over ill-smelling alcoholics, or tediously dissecting some fresher specimen. The time needed to plot the pterylosis of one bird would make the skins of a score, and give results far more filling to the cabinet and pleasing to the eye.

Does not Dr. Allen, in his note appended to Mr. Clark's letter, tell us of months of toil whose results have never been published, and did not Dr. Allen give up the study of pterylography? And did not Mr. Ridgway give us a most important paper on the osteology of the Falconidæ, and did he ever give us a second?

If, then, acknowledged leaders like these should seem to prefer the external characters of birds, it is small wonder that lesser men should strive to follow in their footsteps. Nevertheless it is a pity, with so much work yet to be done, so many problems still unsolved, that so large a number of our ornithologists should keep on amassing skins, as if that were the chief end of ornithology.

Washington, D. C., Feb. 19, 1893.

FREDERIC A. LUCAS.

NOTES AND NEWS.

THE UNVEILING of the monument to JOHN JAMES AUDUBON, at Trinity Cemetery, New York City, will occur on Wednesday, April 26, 1893, at 3 P. M., under the auspices of the New York Academy of Sciences, with appropriate addresses by Professor Thomas Egleston and others. The exercises at the cemetery will be followed by a commemorative meeting in the lecture hall of the American Museum of Natural History, at 8.30 P. M., at which an address will be delivered by Mr. D. G. Elliot, on 'The Life and Services of Audubon.' The monument has been completed in accordance with the plans announced some time since in 'The Auk' (V, 1888, p. 221). Invitations to attend the public exercises as above announced will be sent to a large number of ornithologists and naturalists, both in this country and abroad.

CAPT. CHARLES E. BENDIRE will be under many obligations to any readers of 'The Auk' for breeding specimens, male and female, of the different species and subspecies of the genera *Junco* and *Otocoris*, nesting west of the Great Plains, and especially those from the Pacific Coast, Arizona and New Mexico. He desires this material for the purpose of enabling him to define the *breeding ranges* of the various species and subspecies as accurately as possible in his work, 'The Life Histories of North American Birds,' now in course of preparation under the direction of the Smithsonian Institution and the United States National Museum, Washington, D. C. Specimens loaned for this purpose will be promptly returned. Accurate and interesting breeding records of our rarer birds will also be acceptable and due credit will be given for the same. Address, CAPT. CHARLES E. BENDIRE, Smithsonian Institution, Washington, D. C.

MR. HUBERT LYMAN CLARK of Pittsburgh, Pa., is studying the pterylography of the North American Gallinæ and is in need of further material. The species especially desired are *Colinus ridgwayi*, *Cyrtonyx montezumæ*, *Lagopus welchi*, and *Tympanuchus cupido*. Mr. Clark would be glad to be placed in communication with any one able to supply alcoholic material or fresh specimens. His address is 3922 Fifth Avenue, Pittsburgh, Pa.

MR. FRANK M. CHAPMAN, of the American Museum of Natural History, New York City, sailed for the Island of Trinidad, B. W. I., February 11, where he will spend several months exploring the natural history of the island, giving, of course, special attention to birds. Late advices announce his safe arrival, and indicate that every prospect is favorable for a rich harvest of ornithological specimens. Although this is by no means a new field, its resources prove not to have been exhausted when subjected to the prying scrutiny of an expert in field work.

A NEW and important limited edition of 'The History of the Expedition under the Command of Captains Lewis and Clark to the Source of the Missouri River, thence across the Rocky Mountains, and down the Columbia River to the Pacific Ocean, performed during the years 1804-5-6, by order of the Government of the United States,' is announced by Francis P. Harper, a New York publisher, to be ready for delivery "in the spring of 1893." This will be a reprint of the original Biddle-Allen edition of 1814, under the competent and especially fitting editorship of Dr. Elliot Coues. The original two volumes will be expanded to four, through the addition of copious explanatory, geographical and scientific notes to the text, and of bibliographical and biographical matter. Dr. Coues is fortunate in having access to the original journals and field notes of both Captains Lewis and Clark, and other authentic original documents bearing on the history of this famous expedition. That he will use them to the best advantage is beyond question, with results of the highest interest to the naturalist and the historian.

WE HAVE received a prospectus of a work entitled 'The Birds of Montreal, 1893,' by Mr. Ernest D. Wintle. It will be a copiously annotated list of the birds of the Island of Montreal and vicinity, with some illustrations of the rarer species, giving the results of Mr. Wintle's ten years' observations in the district mentioned. The book will be sold by subscription, by Desbarats and Co., 73 St. James St., Montreal.

THE FOLLOWING changes and corrections should be made in the addresses of English Members of the A. O. U. as recently published in 'The Auk':—

DALGLEISH, JOHN J., Blackstone Grange, Bogside Station, Stirling, Scotland.

HUXLEY, Prof. THOMAS H., Eastbourne, Sussex, England.

LAYARD, EDGAR L., care Zoölogical Society, 3 Hanover Square, London, W.

OATES, EUGENE W., care Zoölogical Society, 3 Hanover Square, London, W.

SEEBOHM, HENRY, 22 Courtfield Gardens, London, S. W.

SHELLEY, Capt. G. E., 10 Thurloe Square, London, S. W.

WALLACE, Prof. ALFRED R., Parkstone, Dorset, England.

The following are to be added to the list of Associate Members:—

FOWLER, FREDERICK HALL, Foot Bowie, Arizona.

GILBERT, HAROLD L., 149 13th St., Portland, Oregon.

HEYLER, J. C., Nauvoo, Pennsylvania.

MÉNGE, Capt., J. F., Myers, Florida.

MILLER, H. E., Croton Falls, New York.



Enth. by Konradinus Palla.

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HYBRID. JUNCO. + ZONOTRICHIA.